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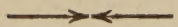

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Tôkyô

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A New Shrimp, *Harpilius imperialis*[1]

Ituo Kubo

(Received April 16th, 1940)

It is with the greatest honour that the present author reports on the collection of shrimps by H.I.M. the Emperor during his visit to southern islands. The specimens came under his examination through the courtesy of the authorities of Imperial Household and Professor Arata Terao and one of them proved to be new to science.

The present work was carried out under the supervision of Prof. A. Terao, to whom his hearty thanks are due.

Harpilius imperialis sp. nov.

(Figs. 1~3)

Body slightly depressed. Rostrum horizontal, but upper border slightly convex, about two-thirds the length of carapace, dorsal carina extends backwards to anterior two-fifths of carapace, upper border armed with 7 teeth (excluding a subterminal small spine), posterior three of which are placed on carapace, lower border with one spine inserted under upper fifth rostral spine (Fig. 1). Carapace with an antennal spine and without hepatic one, and with rounded antero-lateral angle. Abdominal terga not medially carinated. First to fourth abdominal pleura rounded on inferior margin. Telson shorter than uropods; subrectangular in upper aspects but reducing its width posteriorly, ratios against breadth between postero-lateral angles: length 6.5, width near proximal border 3, armed along each dorso-lateral margin with two bristles, one at middle and the other at midpoint between middle and distal end, distal margin convex with one pair of outer shorter and two pairs of inner longer bristles (Fig. 3, *G*). Antennular peduncle does not extend to tip of rostrum; basal segment about twice as broad as penultimate segment, provided with a large lanceolated lateral process,

(1) Contributions from the Zoological Laboratory, Imperial Fisheries Institute, No. 100.

Fig. 1. *Harpilius imperialis* sp. nov., ♂, ×6.

distal outer angle ends in a large spine which reaches distal margin of penultimate segment, second and third segments equal in length, ultimate segment bears inner thinner and outer thicker flagella, outer shorter flagellum with proximal portion comprising 7 joints, and distal portion bifid with outer longer and inner shorter (two-jointed) branches (Fig. 3, *A*). Scaphocerite reaches slightly beyond tip of rostrum. Mandible without palp, incisor process provided with four teeth on distal margin (Fig. 2, *A*). Maxillule cross-shaped; inner lacinia slender, fringed with long hairs at apex; outer lacinia narrow, furnished with several bristles on apical margin; endopodite without distal lobe (Fig. 2, *B*). Maxille with ear-shaped exopodite, papilla-like endopodite and single, slender lobe of inner distal endite; proximal endite absent (Fig. 2, *C*). All three maxillipeds provided with exopodite and mastigobranchia (Fig. 2, *D*, *E* and *F*). Lobe on exopodite of first maxilliped remarkably small (Fig. 2, *D*). Third maxilliped pediform, distal three segments slender, proportion to ultimate segment: penultimate one 1.5, antepenultimate one 2.0 (Fig. 2, *F*). First pereiopod slender about 1.2 times as long as carapace, ratios to movable finger: palm 1.4, carpus 5, merus 4, ischium 2.7 (Fig. 3, *B*). Second cheliped asym-

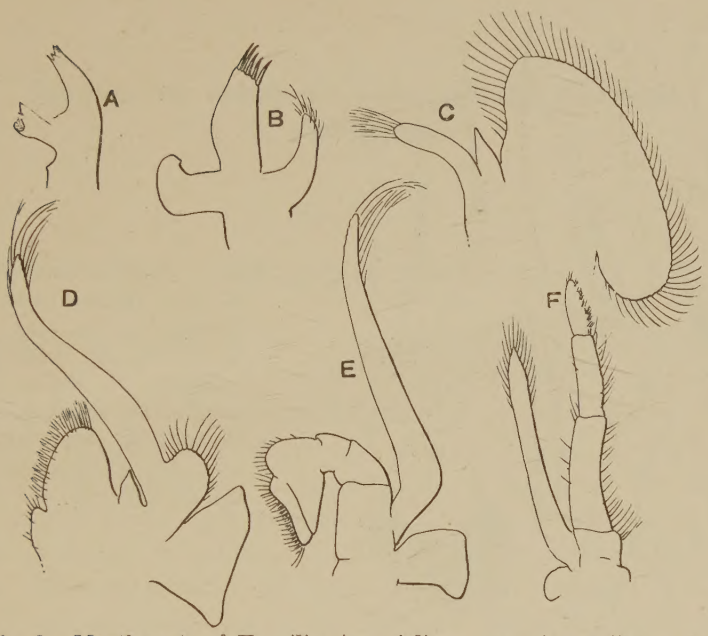


Fig. 2. Mouth-parts of *Harpilius imperialis* sp. nov. *A*, mandible, ×25; *B*, maxillula, ×35; *C*, maxilla, ×35; *D*, first maxilliped, ×25; *E*, second maxilliped, ×25; *F*, third maxilliped, ×20.

metrical; larger leg about 3.8 times as long as carapace; movable finger, carpus and merus subequal in length, palm about 1.7, ischium 1.5, times as long as movable finger; fingers with inturned tips and leave no space between them when closed; both prehensile edges of fixed and movable fingers provided in proximal two-thirds with about 7 blunt denticles, very irregular in size and distribution (Fig. 3, *C*); smaller leg about 2.7 times as long as carapace; proportions of each segment to movable finger: palm 1.2, carpus and merus 0.8, ischium 0.6, denticles on cutting edges less prominent than those of larger leg (Fig. 3, *D*). Third leg stouter and longer than first leg; about 1.5 times as long as carapace; dactylopodite proximally broad, distally bearing strongly recurved single claw, about two-ninths times of propodus in length; ratios against propodus: carpus and ischium 0.4, merus 0.8 (Fig. 3, *E* and *F*).

Branchial formula:—

	I	II	III	IV	V	VI	VII	VIII
Pleurobranchiae	—	—	—	1	1	1	1	1
Arthrobranchiae	—	—	—	—	—	—	—	—
Podobranchiae	—	—	—	—	—	—	—	—
Mastigobranchiae	1	1	r	—	—	—	—	—

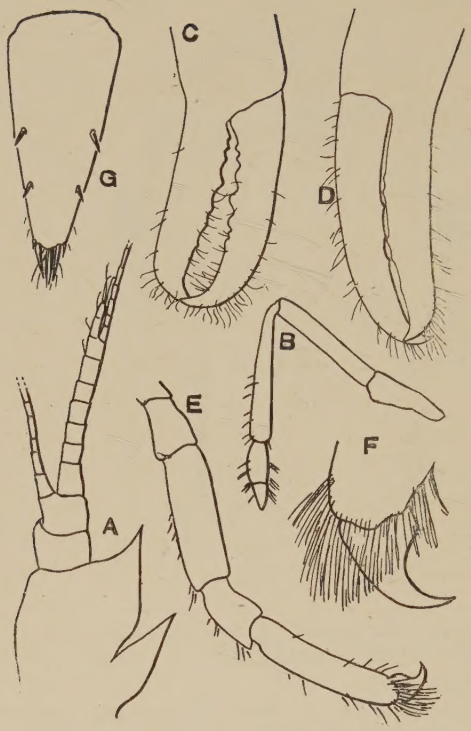


Fig. 3. *Harpilius imperialis* sp. nov. *A*, first antenna, ×20; *B*, first thoracic leg, ×ca. 10; *C*, fingers of larger chela of second pereiopod, ×ca. 10; *D*, fingers of smaller chela of the same pereiopod as in *C*, ×15; *E*, fourth thoracic leg, ×ca. 10; *F*, dactylus of fourth thoracic leg, ×35.

The above mentioned description is based on a single male specimen, measuring 12.5 mm in body length.

Type locality: Nankin-Hama, Haha-zima, Bonin Islands.

The present species is closely allied to *H. gerlachei* NOBILI (KEMP, 1922, p. 238) but readily distinguished from it as shown in the following table:—

	H. gerlachei	The present species
1. Upper rostral spine number.	3—5	7
2. Dorsal carina of carapace.	without tooth	with 3 teeth

KEMP, S., 1922. Notes on Crustacea Decapoda in the Indian Museum. XV. Pontoniinae. Rec. Ind. Mus., vol. 24.

Studies on Japanese Palaemonoid Shrimps
I. Palaemon[1]

Ituo Kubo

(Received April 16, 1940)

Various authors have added to our knowledge of Palaemonoid fauna of Japan. And yet much has been left to be desired in this connexion. For several years past, the material in question has come rather sufficiently under my examination from Japan and adjacent regions so that I am now in a position to supplement, to a degree, the taxonomy of the group.

The present paper deals with not only 6 of the already known 9 species of the genus *Palaemon* but also one new and three species which are new to Japan. The material for this paper was mostly obtained from Riu-kiu Islands by the intermediation of Dr. Yaichirô Okada and others, who had been able to make the collection with the aid of a research fund from Marquis Yamashina, and kindly placed at my disposal. It is my pleasant duty to return herewith my gratitude for this favour. I am also under obligation to Drs. Masamitsu Ôshima and Denzaburo Miyadi, Messrs. Sadayosi Miyake, Ichinosuke Okukawa, Tokutarô Momiyama, Ukyo Oo and Genkiti Abe for cordial supply of the material from various parts of Japan.

The present work was carried out under the supervision of Dr. Arata Terao, to whom I must express my hearty thanks.

Genus ***Palaemon*** Fabricius

Palaemon, Milne-Edwards, 1837, p. 395; Stimpson, 1860, p. 110; Ortmann, 1891, p. 693; Schmitt, 1921, p. 35.
Macrobrachium, Bate, 1868, p. 363.
Bithynis, Bate, 1888, p. 788; Rathbun, 1902, p. 123.
Brachycarpus, Bate, 1888, p. 788.

Body smooth, slightly laterally compressed. Rostrum laterally compressed, prominently toothed above and below. Carapace with antennal and branchiostegal spines. Mandible with three-segmented palp. First and

1) Contributions from the Zoological Laboratory, Imperial Fisheries Institute, Tokyo, No. 101.

second pairs of legs chelate, the latter larger and stouter than the former. Dactyli of last three pairs of legs simple. Branchiae arranged as follows:—

	g	*h*	*i*	*k*	*l*	*m*	*n*	*o*
Pleurobranchiae	—	—	—	1	1	1	1	1
Arthrobranchiae	—	—	1+r	—	—	—	—	—
Podobranciae	—	1	—	—	—	—	—	—
Mastigobranchiae	1	1	—	—	—	—	—	—

Key to the species of the genus *Palaemon*

A. Rostrum with 10~15 spines on upper border
  B. Both upper and lower borders of rostrum convex in profile
    C. Rostrum neither shallow nor reflexed at apex
      D. Second cheliped 1.0~1.3 times as long as body in male
        E. Fingers of second cheliped hairy in male; proportion of length of telson to its breadth between postero-lateral angles: 9.5~10.5 ..... ***P. nipponensis.***
        E′. Fingers of second cheliped not hairy; proportion of length of telson to its breadth between postero-lateral angles: 7.0~8.0 ..... ***P. philippinensis.***
      D′. Second cheliped 1.7~1.9 times as long as body in male ..... ***P. longipes.***
    C′. Rostrum shallow and reflexed at apex
      F. Second cheliped depressed; oval in cross-section, covered with thickly set setae ..... ***P. japonicus.***
      F′. Second cheliped not depressed; subcircular in cross-section, covered with sparsely set setae ..... ***P. boninensis.***
  B′. Rostrum a little elevated, upper border horizontally straight and lower border convex in lateral view
    G. Second cheliped heavy, asymmetrical, finely covered with setae, palm depressed and oblong in cross-section ..... ***P. grandimanus.***
    G′. Second cheliped slender, symmetrical, not covered with setae, palm not depressed and approximately circular in cross-section
      H. Rostrum reflexed at apex ..... ***P. sundaicus.***
      H′. Rostrum not reflexed at apex ..... ***P. riukiuensis*** sp. nov.
A′. Rostrum with 7~8 spines on upper border
  K. Rostrum reaches to or somewhat beyond the tip of antennular peduncle. Second cheliped not hairy, leaving a space between both fingers of the chela ..... ***P. lar.***
  K′. Rostrum does not reach to the tip of antennular peduncle. Second cheliped hairy, leaving no space between both fingers of the chela ..... ***P. latimanus.***

Palaemon nipponensis DE HAAN

(Pl. I, Fig. f and Text-figs. 1 and 2)

Palemon nipponensis DE HAAN, 1850, p. 171; DE MAN, 1879, p. 175; LANCHESTER, 1901, p. 640; BALSS, 1914, p. 59; 1924, p. 50; DOFLEIN, 1902, p. 640; KEMP, 1918, p. 258; YÜ, 1931, p. 271.

Palaemon (Eupalaemon) nipponensis, ORTMANN, 1891, p. 713, taf. 47, fig. 4; DE MAN, 1892, p. 441; PARISI, 1919, p. 80, taf. fig. 2.

Bithynis nipponensis RATHBUN, 1902, p. 53.

Rostrum 0.6～0.8 times as long as carapace, slightly beyond distal end of antennular peduncle, dorsal carina extending backwards almost to the middle of carapace, armed with 12～14 spines, posterior 3 of them placed on carapace, interval between the hindmost spine and penultimate one somewhat larger than as found between other rostral spines; lower border with 2～3 spines (Fig. 2, *A*). Pleura of anterior three abdominal segments rounded on lower margin, first and third ones overlapped by second one, fourth and fifth ones blunt at posterior angle. Telson shorter than uropods, ratio of length against breadth between postero-lateral angles 10:1, furnished along each dorso-lateral margin with two bristles; one medially and the other distally; posterior border obtusely pointed at middle and armed with one pair of inner longer and one pair of outer shorter bristles; a tuft of hairs planted on dorsal median line near proximal border (Fig. 2, *D* and *C*). Mandible consists of molar and incisor processes, provided with three-segmented palp (Fig. 1, *A*). Maxillula with rather narrow inner laciniae (Fig. 1, *B*). Scaphognathite of maxilla rounded posteriorly (Fig. 1, *C*). All three maxillipeds with exopodite; endopodite of first maxilliped unsegmented (Fig. 1, *D*). Third maxilliped reaches to distal end of second

Fig. 1. Mouth-parts of *Palaemon nipponensis*. *A*, mandible, ×7; *B*, maxillula, ×7; *C*, maxilla, ×5; *D*, first maxilliped, ×7; *E*, second maxilliped, ×5.

antennal peduncle. First leg about half times as long as body without rostrum. Second leg 1.0～1.3 times as long as body in male but 0.6～0.7 times in female; fingers of mature male hairy (Pl. 1, middle of *D*), with ratios of each segment to finger: propodus 1.4 in male, 1.3 in female; carpus 1.8 in ♂, 1.9 in ♀; merus 1.1 in ♂, 1.3 in ♀. Third leg much longer than first

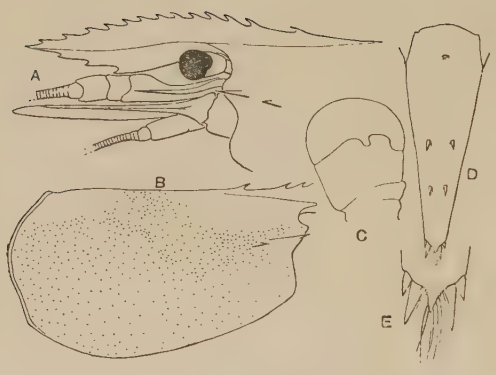


Fig. 2. *Palaemon nipponensis*, ♂, 80 mm long procured from Miya, Aiti Prefecture. *A*, frontal aspect, ×1.3; *B*, showing distribution spinules on the carapace; *C*, upper aspect of eye, ×4; *D*, telson, ×4; *E*, tip of telson, ×ca. 13.

one. Fourth and fifth legs nearly similar in general aspects and proportions. Endopodite of second abdominal appendage with shorter stylamblys and longer appendix musculina in male, but stylamblys only in female.

The foregoing description is based on 8 males, ranging from 60.0 mm to 86.0 mm in body length, and 15 females 59.0～73.7 mm in body length, collected from the following localities.

Localities: Miya, Aiti Prefecture; Hamanako, Sizuoka Prefecture; Turumi-gawa, Kanagawa Prefecture; Ogura-ike, Kyoto Prefecture; Yukuhasi, Hukuoka Prefecture.

Distribution: Yokohama (Parisi); Wakanoura, Kii, Chikugo River, Kurume (Rathbun); Yodo River, Kasumigaura (Kemp); Shanghai, Pei-

Table 1.

♂, dimensions in mm.

No.	B.L.	Second pereiopod												Locality
		A		A/D		B		B/D		C		C/D		D		
		R	L	R	L	R	L	R	L	R	L	R	L	R	L	
1	86.0	24.0	26.0	1.0	1.1	40.0	41.0	1.7	1.7	35.0	35.0	1.5	1.5	23.0	24.0	Miya
2	85.0	25.0	—	1.0	—	40.0	—	1.7	—	34.0	—	1.4	—	24.0	—	"
3	80.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	"
4	79.0	25.0	25.5	1.4	1.1	37.8	41.0	2.1	1.8	27.6	32.8	1.5	1.5	18.0	22.3	"
5	77.0	17.6	24.0	1.4	1.0	26.5	38.5	2.0	1.6	20.0	30.0	1.5	1.3	13.0	24.0	Yukuhasi
6	76.0	25.5	22.5	1.3	1.1	36.0	36.4	1.8	1.8	28.0	29.4	1.4	1.5	19.7	20.0	Ogura-ike
7	71.0	—	19.7	—	1.1	—	30.7	—	1.7	—	23.0	—	1.3	—	17.7	"
8	60.0	—	9.5	—	1.1	—	14.0	—	1.6	—	10.0	—	1.0	—	9.0	Miya

♀, dimensions in mm.

No.	B.L.	Second pereiopod														Locality
		A		A/D		B		B/D		C		C/D		D		
		R	L	R	L	R	L	R	L	R	L	R	L	R	L	
1	62.4	—	8.0	—	1.2	—	11.5	—	1.8	—	7.0	—	1.1	—	6.5	Miya
2	62.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	»
3	68.0	9.5	9.5	1.3	1.2	13.0	14.1	1.8	1.8	9.6	9.3	1.4	1.2	7.1	8.0	»
4	69.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	»
5	64.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	»
6	60.2	7.5	—	1.3	—	11.5	—	2.0	—	7.5	—	1.3	—	5.8	—	»
7	63.0	8.0	9.0	1.2	1.4	13.3	12.2	2.0	1.9	7.5	7.5	1.2	1.2	6.5	6.3	»
8	63.5	9.8	—	1.4	—	12.5	—	1.8	—	8.6	—	1.2	—	7.0	—	»
9	63.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	»
10	59.0	8.0	—	1.2	—	12.0	—	1.9	—	8.1	—	1.3	—	6.4	—	Lake Hamana
11	68.5	—	10.0	—	1.3	—	14.8	—	1.9	—	10.0	—	1.3	—	8.0	»
12	71.0	10.5	—	1.1	—	15.0	—	1.6	—	12.0	—	1.3	—	9.2	—	»
13	67.0	10.5	—	1.5	—	15.2	—	2.2	—	10.0	—	1.4	—	7.0	—	»
14	73.7	11.0	11.0	1.3	1.4	17.0	16.5	2.0	2·0	11.5	11.9	1.4	1.5	8.5	8.1	Turumi-gawa
15	62.5	—	9.5	—	1.3	—	14.0	—	1.9	—	9.5	—	1.3	—	7.4	»

A, merus; B, carpus; C, propodus; D, dactylus; B.L., body length;
R, right; L, left.

chu, Tsungming, Yangchow, Soochow, Chinkiang, Kiukiang, Hankow, Nanchang, Chengtu, Lac d'Ouest, Kashing, Amoy, Tsinan, Chefoo, Peitaiho, Chinwangtao, Shanhaikwan (Yü).

Note: Antennal, hepatic, intermediate region between gastric and cardiac regions, and branchial regions of carapace (Fig. 2, *B*) as well as pleura of anterior five abdominal segments are finely tuberculated in male which measures more than 70 mm in length, but it appears that such is not the case with young male and female.

The second pereiopod is slightly asymmetrical in size; the length and ratios of merus, carpus and propodus against dactylus show considerable variations. Table 1 gives concisely such findings. So far as the writer's observation goes, proportions of each segment consisting of the third, fourth and fifth legs are nearly equal in both sexes: it ranges from 1.0 to 1.4 in merus; 1.6~2.1 in carpus; 1.0~1.5 in propodus in male, but in female 1.1~1.5 in merus and propodus; 1.6~2.0 in carpus. The hairs covering the

fingers of the leg becomes conspicuous when the animal attains about 60 mm in the body length.

Palaemon philippinensis COWLES

(Pl. 1 and Text-figs. 3 and 4)

Palaemon philippinensis COWLES, 1914, p. 340, pl. 2, figs. 2, 2 (a~m).

Rostrum lanceolated, very slightly descending, about half times as long as carapace, and a little beyond the tip of antennular peduncle, dorsal border extending backwards almost to the middle of carapace, forming moderate dorsal carina; it bears 9~13 spines, posterior 3 or 4 of which are placed on dorsal carina; ventral border toothless toward the tip but with 1~4 spines near its middle (Fig. 3, *A*). Abdominal pleura exactly similar in form to those of *P. nipponensis*. Telson resembles that of *P. nipponensis*, but ratio of length against breadth between postero-lateral angles 7.7~8.0:1 (Fig. 3, *E* and *F*). Eyes moderate, occupied by kidney-shaped cornea in

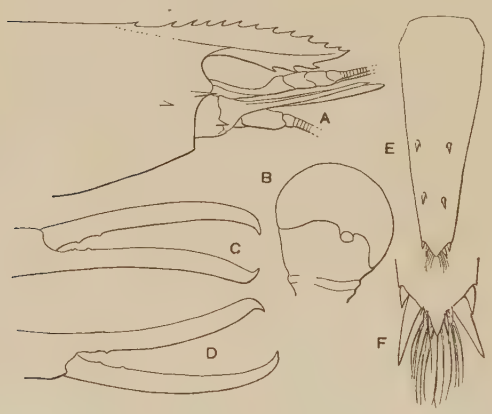


Fig. 3. *Palaemon philippinensis*, ♂, 72 mm long, secured from Riu Kiu. *A*, frontal aspect, ×1.4; *B*, upper aspect of eye, ×ca. 7; *C*, outer view of second chela (left); *D*, same as C (right); *E*, telson, ×ca. 3; *F*, tip of telson, ×ca. 13.

distal half, corneal spot somewhat large (Fig. 3, *B*). Antennal scale well beyond tip of rostrum. Mouth-parts almost the same as those of the previous species in general aspects. First pereiopods about half times as long as body. Second pereiopods as long as or a little longer than body, proportions to movable finger: palm 1.3 in ♂, 1.5 in ♀; carpus 1.3 in ♂, 1.5 in ♀; merus 0.9 in ♂, 1.2 in ♀; fingers not hairy (Pl. 1, *D* and Fig. 3, *C* and *D*). Third, fourth and fifth pereiopods as long as first one, but somewhat stouter. Endopodite of second abdominal appendage with stylamblys and appendix masculina on inner proximal border in male, but stylamblys only in female.

Described from 21 male specimens, 25.0～85.0 mm in body length, 21 females, 29.5～67.0 mm in body length, collected by Dr. Yaichirô Okada and Mr. Isamu Horazawa.

Localities: Kuzi-gawa, Genka-gawa, Izumi (Okinawa-zima); Sirakawa (Miyako-zima).

Distribution: Philippines (Cowles, Estampadora).

Note: Cowles characterized this species by the presence of tubercles along both sides of the cutting edges of the chela of the second pereiopods, but such tubercles are not found in my specimens. The present species is closely related to *P. nipponensis* de Haan, but differs from it in the absence of the rather thick coating of hairs on the fingers of second chelipeds as already mentioned by Cowles.

It is worth mentioning that both sexes of the present species differ in size: females are generally smaller than males in body-build (Fig. 4). But they do not show significant differences in the proportions of the bodily parts. The growth of movable finger, palm, carpus, merus of the second cheliped in relation to that of body was studied in both sexes and represented in Fig. 4.

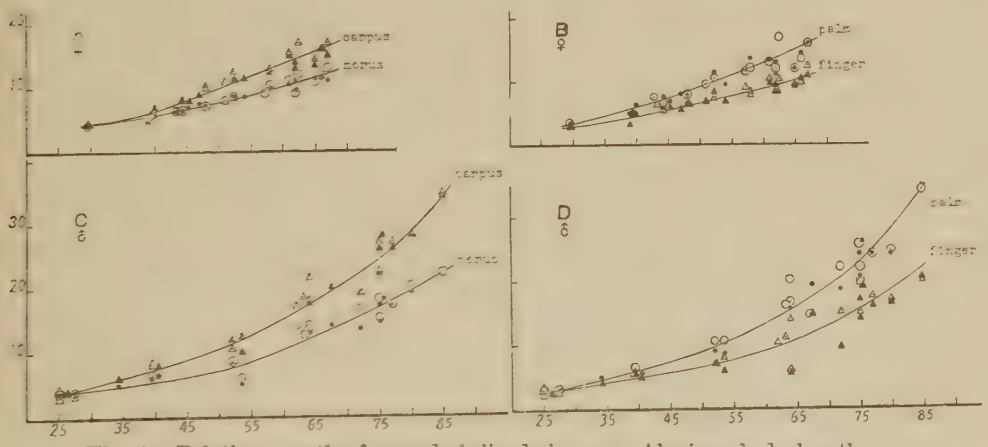


Fig. 4. Relative growth of second chelipeds in mm. Abscissa, body length; ordinate, length of each segment (black, right; white, left).

Palaemon longipes de Haan

(Pl. 1, D and Text-fig. 5)

Palemon longipes de Haan, 1850, p. 171; de Man, 1897, p. 177; Ortmann, 1891, p. 715; Balss, 1924, p. 50.

Palaemon (*Eupalaemon*) *longipes* PARISI, 1919, p. 79, Tav. 6, fig. 4.
Macrobrachium longipes, MAKI and TUTIYA, 1923, p. 61, pl. 7, fig. 3.

Rostrum almost similar to that of *P. nipponensis* and of *P. philippinensis* in form, slightly beyond antennular peduncle, but does not reach to distal margin of antennal scale, both upper and lower borders convex in outline, dorsal carina extending backwards to about middle of carapace, armed with 12 spines, posterior 3 of which are placed on carapace, lower border with 3 spines but no subterminal one (Fig. 5, *A*). Pleura entirely resemble those of *P. nipponensis* and of *P. philippinensis*. Telson shorter than uropods, provided with a median tuft of hairs near proximal border, armed with two pairs of spinules on dorso-lateral margins, posterior border pointed at middle bearing one outer pair of shorter and one inner pair of longer spinules, ratio of length against breadth between postero-lateral angles 8:1 (Figs. 5, *C* and *E*). Eyes rather short, covered with somewhat kidney-shaped cornea in distal half, ocular spot large (Fig. 5, *B*). Mouth-parts

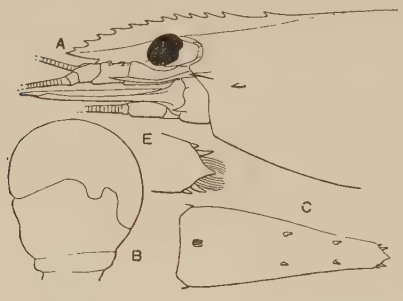


Fig. 5. *Palaemon longipes*, ♂, 73 mm long, collected from Kamakura, Kanagawa Prefecture. *A*, frontal aspect, ×ca. 1.3; *B*, upper aspect of eye, ×5; *C*, telson, ×ca. 2.3 *E*, tip of telson, ×5.

exactly the same as the corresponding ones of *P. nipponensis* and *P. philippinensis* in form. First pereiopods slender and a little shorter than half of body. Second leg very stout and long, 1.7~1.9 times as long as body; palm 1.5~2.1 times as long as movable finger; carpus a little longer than palm; merus 0.5~0.7 times as long as carpus; fingers with two teeth on prehensile edge, leaving a nearly crescent space between them when closed (Pl. 1, Fig. *D*). Third, fourth and fifth ambulatory legs almost equal in length and somewhat stouter than the first one. Endopodite of second pleopod with a shorter stylamblys and longer appendix musculina thickly set with hairs on inner border.

Material examined: A male 73.0 mm in body length collected from Kamakura by Dr. Nagamichi KURODA and a male 75.5 mm long, secured by Dr. Yaichirô OKADA from Sirakawa, Miyako-zima (Riu-Kiu).

Distribution: Japan (de Haan, de Man); Taihoku, Formosa (Maki and Tutiya); Nagasaki; Loochoo (Parisi).

Note: The specimens at my disposal agree well with the description of de Haan of the present species, but differs from de Man's (1879) description in having three closely set conical tubercular teeth and one larger conical tooth on proximal prehensile edge of fixed finger whereas only one tooth is present in de Man's material.

The present species is distinguished from the previous two species, *P. nipponensis* and *P. philippinensis*, by the following characters: cheliped remarkably long and a space left between fingers of its chela when closed. It is separated from the former by having globular eye and lacking thickly set hairs on fingers of second cheliped.

The present species is not so common in Japan proper as *P. nipponensis*.

Palaemon japonicus de Haan

(Pl. 2, fig. D and Text-figs. 6 and 7)

Palemon japonicus de Haan, 1850, p. 172; de Man, 1879, p. 175; Ortmann, 1891, p. 726; Balss, 1924, p. 50.

Palaemon (Parapalaemon) japonicus, de Man, 1892, p. 462, pl. 27, fig. 40; Parisi, 1919, p. 83, pl. 6, figs. 3 and 11.

Macrobrachium japonicus, Maki and Tutiya, 1923, p. 63, pl. 5, fig. 2.

Rostrum rather shallow, somewhat descending, about 0.4 times as long as carapace, reaches to distal end of antennular peduncle, both upper and lower borders convex, dorsal carina ending near the middle of carapace, with 9~12 spines, posterior four or three of them situated on carapace, ventral border with 2~4 spines (Fig. 6, *A*). Telson shorter than uropods, proportion of length against breadth between postero-lateral angle 8:1, ratio of proximal breadth to distal one 3:1, with a median tuft of hairs near proximal border, armed with two pairs of spinules along dorso-lateral margin, acutely tipped at middle of distal border bearing one outer smaller and inner larger spinule and subterminal tuft of hairs on each side of the tip (Fig. 6, *K*). Eyes moderate, distally covered with cornea not reaching half in extent, ocular spot moderate (Fig. 6, *B*). Mouth-parts quite resemble those of *P. nipponensis* in form. First cheliped symmetrical and slender, about half times as long as body. Second one asymmetrical, wholly covered with thickly set setae, larger hand approximately 1.4 times as long as body but smaller one about 1.1 times in male, proportions against finger: merus 0.9~1.3 in larger hand of males above 50 mm in body length, 1.0~1.5 in

smaller one of the same, 1.1~1.2 in larger hand, 1.1~1.4 in smaller one of females above 50 mm in body length; carpus 1.0~1.4 in larger hand, 1.1~1.8 in smaller one of male, 1.3~1.4 in larger one, 1.3~1.5 in smaller one of females above 50 mm in body length; carpus 1.0~1.4 in larger hand, 1.1~1.8 in both larger and smaller ones of female, fingers somewhat curved inwards, leaving a small space between them when closed; movable one with a strong tooth near middle of prehensile edge and several smaller teeth (3 or 4) on proximal edge, immovable one of larger hand also armed along cutting edge with a series of teeth distally gradually increasing in size; both fingers armed with several somewhat smaller teeth on proximal cutting edges in smaller hand of male (Fig. 6, *C* and *D*); but with smaller teeth in female than in male. Endopodite of first pleopod lobe-like in outline in both sexes (Fig. 6, *F*). Endopodite of second pleopod carries a shorter stylamblys and the other longer appendix masculina fringed with densely set hairs on inner border in male (Fig. 6, *G*), but in female with a stylamblys only (Fig. 6, *H*).

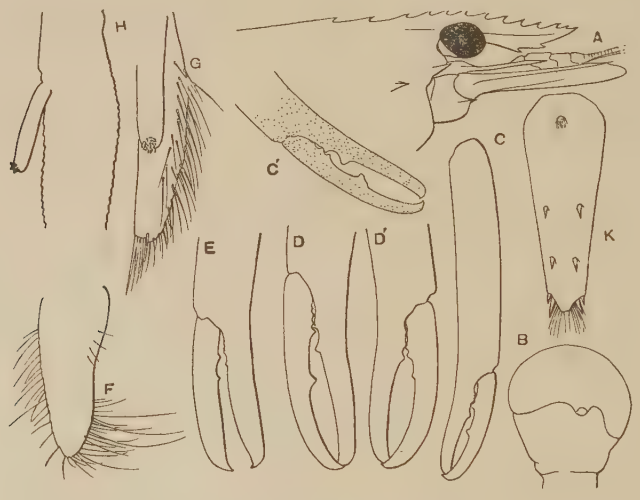


Fig. 6. *Palaemon japonicus*, ♂, 62 mm in body length obtained from Riu Kiu. *A*, frontal aspect, ×ca. 1.4; *B*, upper aspect of left eye, ×5; *C*, smaller chela of second pereiopod, ×ca. 1.3; *C'*, larger chela of the same pereiopod as *C*, ×ca. 1.3; *D*, a type of second chela of the same species (larger chela), ×ca. 1.6; *D'*, same as *D* (smaller chela), ×ca. 2.7; *E*, left chela of second cheliped in female, ×4; *F*, Endopodite of first pleopod in female, ×ca. 16; *G*, stylamblys and appendix masculina removed from second pleopod, ×ca. 13; *H*, endopodite of second pleopod with stylamblys in female, ×ca. 13.

Described from 25 males measuring 21.5～78.0 mm long without rostrum and 18 females ranging 35.0～63.0 mm long obtained by Dr. Yaichirô Okada and others, and two males collected by the present author in August of 1936 in Itiki, Kagosima.

Note: Seeing that the largest female is nearly as half in size as the largest male in my collection, it may be taken that a lower rate of growth exists in the female than in the male. But if, on the contrary, the rate of growth is the same in both sexes and larger females are not represented somehow in the material at my disposal, it follows that the relative growth of second cheliped as well as its several joints (Fig. 7) does not significantly differ in both.

That larger males have the second cheliped distinctly spooned but smaller males have the corresponding appendage almost as straight as that of females is worth mentioning but it is of no value to decide between the above-mentioned two alternatives.

Localities: Henoki, Nakizin, Kinmura, Genka-gawa, Kuzi-gawa, Idumi, Yohuke-gawa, Hentona, Sasiki-mura (Okinawa); Simozi, Hora-gawa (Miyakozima); Riu Kiu Island: Itiki, Kagosima Prefecture.

Distribution: Japan (de Haan); Kagi, Formosa (Parisi); Tansui, Formosa (Maki and Tutiya).

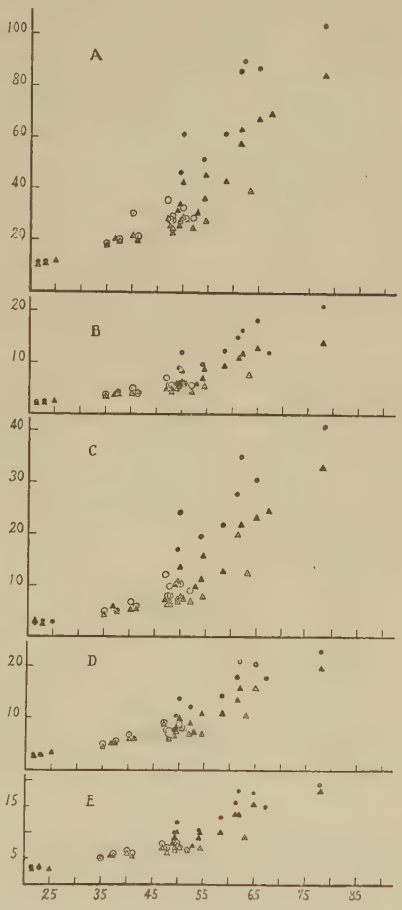


Fig. 7. Length of second pereiopod (A) measuring from proximal border or merus to tip of chela, finger (B), palm (C), carpus (D) and merus (E) in relation to body length without rostrum in mm; circle, larger leg; triangle, smaller leg (solid ones representing males).

Palaemon boninensis Stimpson

(Figs. 8 and 9)

Palaemon boninensis STIMPSON, 1860, p. 41; ORTMANN, 1891, p. 706.

Female: Body smooth. Carapace with rounded pterygostomian angle. Rostrum almost horizontal, nearly lanceolate in profile, reaches to or slightly beyond the tip of antenular peduncle, a little longer than half of carapace, upper border passes into dorsal carina which extends to the middle of carapace and has a consecutive series of 12 spines on it: 4 carinal and 8 rostral ones, the first rostral one situated near apex; lower border provided with 3 subterminal spines (Fig. 8). Pleura entirely agree with those of

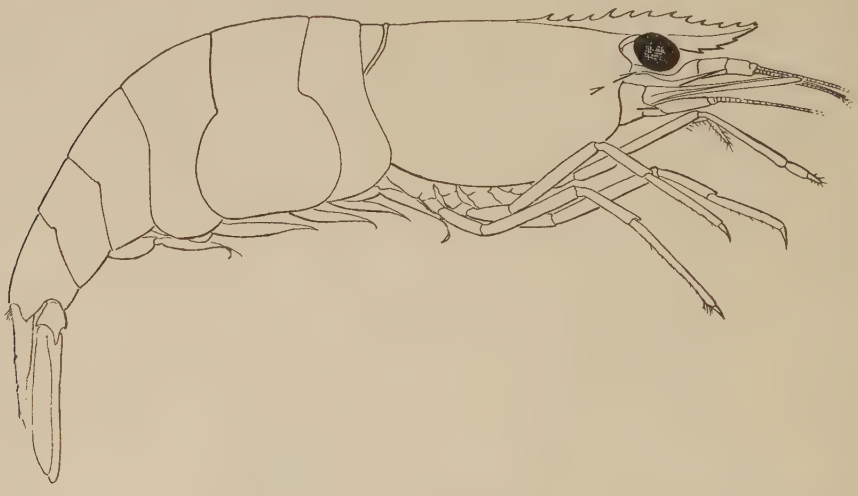


Fig. 8. *Palaemon boninensis*, ♀, ovigerous, 48 mm long, collected from Titi-zima, Bonin Island, × 2.

P. nipponensis in shape. Telson shorter than uropods, armed along each dorso-lateral margin with two spinules, one middle and one distal; distal margin rectangularly pointed, with two pairs of outer shorter and inner longer (about twice as long as outer one) bristles, provided with long plumose hairs on ventral subterminal region (Fig. 9, *E*). Mouth-parts wholly resemble those of *P. nipponensis*, third maxilliped not reaching to terminal margin of antennular peduncle when stretched out. First cheliped slender, about 1.5 times as long as carapace. Third leg much stouter but slightly longer than first one: about 1.7 times as long as carapace, ratios to propodus: dactylus 0.3; carpus 0.7; merus 1.4. Fourth and fifth legs nearly similar to third one in shape and proportions, but fifth leg fringed with a tuft of hairs near distal border of propodus. Endopodite of second pleopod with a stylamblys on inner border (Fig. 9, *D*).

Young male: Much resembles female but differs from it particularly in the following points:—Second cheliped a little longer than carapace, proportions against movable finger: palm 1.4, carpus 1.6, merus 1.6, ischium 1.0; chela sparsely covered with setae, both fingers toothless on cutting edges and hardly leaving space between them when closed (Fig. 9, *B*). Endopodite of second pleopod provided with a short stylamblys and a long appendix masculina furnished with sparsely set hairs on inner border (Fig. 9, *C*).

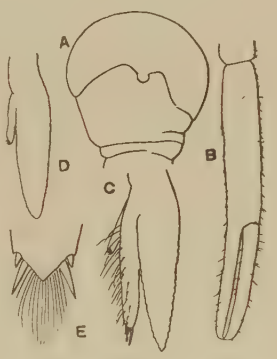


Fig. 9. *Palaemon boninensis*, ovigerous female, 48 mm long, secured from Bonin Island. *A*, upper aspect of eye ×7; *B*, right chela of second pereiopod, ×7; *C*, endopodite of second pleopod bearing stylamblys and appendix masculina, 27 mm in body length, ×ca. 13; *D*, endopodite of second pleopod, ×5; *E*, tip of telson, ×7.

The above description is based on an ovigerous female, second leg of which is wanting, 48.0 mm long, and a young male measuring 27.0 mm in body length. Four immature specimens (3♂, 1♀) ranging 18.5~26.0 mm were also examined. These specimens were secured from Byôbu-dani, Ômura, Titi-zima (Bonin Island) by Mr. Kazue Aramomi in the middle of May of 1938.

Distribution: Bonin Island (Stimpson).

Note: The rostral spines show such variation in its number as 10~12/1~3 in the material placed under my examination.

The rostrum and the appendix masculina of the present species are closely related to those of *P. japonicus* in shape respectively, but the relative length of the latter against the endopodite much larger than that of *P. japonicus*, whereas the appendix masculina extends slightly beyond the middle of the endopodite in *P. japonicus*.

My specimens almost agree with the description of Stimpson excepting the following characters: (1) the carpus of the second cheliped is longer than the half of the chela, (2) the palm about one and a half times as long as the finger (one-third times in Stimpson's description) and (3) the chela of second cheliped bears no tooth on the prehensile edges.

Palaemon grandimanus RANDALL

(Pl. 1, C and Text-fig. 10)

Palaemon grandimanus RANDALL, (Jour. Acad. Nat. Sci. Phila., 8, 1839, p. 142); DANA, 1852, p. 588; 1855, pl. 38, fig. 12 a~b; ORTMANN, 1891, p. 736; LENZ, 1901, p. 436, pl. 32, figs. 4 and 5; ESTAMPADOR, 1937, p. 489.

Bithynis grandimanus BATE, 1888, p. 793, pl. 120, figs. 2 and 3; RATHBUN, 1906, p. 923, pl. 22, fig. 5.

Carapace posteriorly rounded, antero-dorsally carinated and produced to a rostrum which is about 0.7 times as long as carapace; dorsal carina horizontal, provided with 5 spines; upper border of rostrum mostly horizontal but slightly reflexed at tip, and armed with 7 spines, lower border with 3 spines (Fig. 10, *A*). Abdominal pleura entirely resemble those of *P. nipponensis*. Telson nearly oblong, subrectangular, but gradually reducing its width posteriorly, shorter than uropods, and armed with two pairs of spinules at dorso-lateral angle as well on the distal margin as in *P. nipponensis* (Fig. 10, *H*). Eyes pyriform; kidney-shaped cornea obliquely covering half of the stalk; occular spot rather large (Fig. 10, *B*). Antennular peduncle does not reach to apex of rostrum. Scaphocerite terminates at the same level as tip of rostrum. First leg slender, symmetrically chelate, about half times as long as body, reaching beyond antennal scale by the entire chela when stretched out. Second leg asymmetrically chelate, left chela larger than right. Larger chela covered with fine tubercles, about 1.5 times as long as body; ischium 0.24, merus 0.61, carpus 0.7, palm 1.1 in proportion against finger; movable finger with one prominent tooth at proximal one-third and smaller tubercular teeth along distal two-thirds of cutting edge; fixed finger with one strong tooth a little proximal to the corresponding one of the movable finger (Fig. 10, *C*). Smaller chela about 0.9 times as long as body, ratios of each segment to finger: ischium 0.4, merus 0.7, carpus 0.7, palm 0.5; fingers with inturned tips and straight cutting edges (Fig. 10, *E*). Third, fourth and fifth legs much alike in general aspects but the last a little longer than preceding ones, although neither of them reaches beyond antennal scale when stretched out. First pleopod with leaf-shaped endopodite (Fig. 10, *F*). Endopodite of second pleopod provided with a shorter, bar-shaped stylamblys and longer appendix musculina, growing somewhat long setae on almost entire surface in male (Fig. 10, *G*).

Ten males measuring from 22.0 to 51.0 mm in body length and seven females (3 ovigerous and 4 younger) ranging 24.0~38.5 mm in length,

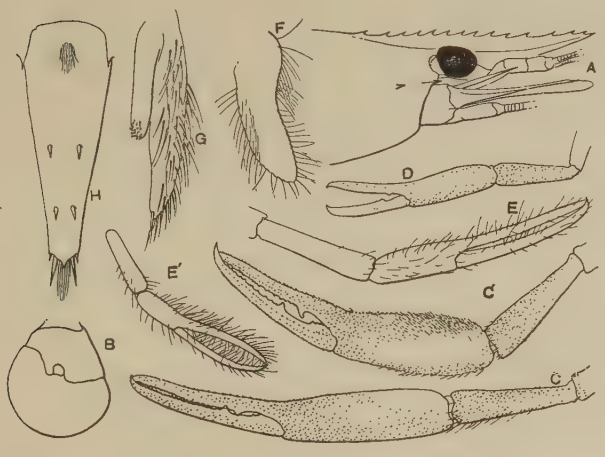


Fig. 10. *Palaemon grandimanus*, ♂, 39.5 mm in body length obtained from Miyako-zima, Riu Kiu. *A*, frontal aspect, × ca. 1.6; *B*, upper aspect of eye, × 5; *C*, larger hand of second pereiopod, × ca. 1.3; *C'*, same as *C* of an aberrant form, × ca. 1.3; *D*, same as *C* of a young male, × ca. 1.6; *E*, smaller hand of second pereiopod, × ca. 1.6; *E'*, same as *E* of the aberrant one, × ca. 1.3; *F*, endopodite of second pleopod, × ca. 13; *G*, stylamblys and appendix masculina of second pleopod, × ca. 16; *H*, telson, × ca. 13.

procured in March, 1936 from Miyako-zima, Riu-Kiu by Dr. Yaichirô Okada and others.

The foregoing description is based on a male, 39.5 mm long without rostrum.

Localities: Sira-kawa, Hora-gawa, Simozi (Miyako-zima).

Distribution: Hawaiian Islands (Dana, Rathbun); Honolulu (Bate); Kalihi, Oahu (Lenz); Philippines (Estampador).

Note: The number of upper rostral spines ranges from 11 to 15 in my specimens as shown in Table 2, whereas it is either 15 or 16 in the Hawaiian ones as reported by Bate and Rathbun.

Table 2.

Number of upper rostral spine	11	12	13	14	15
Frequency	1	8	6	1	1

Another difference may be noted in the degree of convexity of the rostrum in Japanese and Hawaiian specimens. It is very remarkable in the Hawaiian. But it is highly probable that it is due to age since the specimens at my disposal are less than half the Hawaiian in size.

The present species is closely related to *P. philippinensis, P. japonicus, P. longipes* and *P. riukiuensis,* but differs from *P. nipponensis, P. lar* and *P. sundaicus* in the form of the eyes.

It is worth mentioning that this species characterizes the female in having: (1) the second cheliped much smaller, and (2) endopodite of second pleopod provided with stylamblys only.

Palaemon sundaicus HELLER

(Text-fig. 11)

Palaemon sundaicus HELLER, 1862, p. 415, taf. 2, figs. 38 and 39; 1865, p. 115; ORTMANN, 1891, p. 719; COWLES, 1914, p. 355, pl. 2, fig. 3; COUTIÈRE, 1901, p. 335, pl. 14, figs. 44~46; KEMP, 1918, p. 261; YÜ, 1931, p. 276; ESTMPADOR, 1937, p. 489.

Palaemon (Eupalaemon) sundaicus, DE MAN, 1892, p. 437, taf, 26, fig. 35; 1897, p. 779 and **10**, pl. 37, fig. 71; ROUX, 1932, p. 564.

Macrobrachium sundaicus MAKI and TUTIYA, 1923, p. 57, pl. 2, fig. 2.

Rostrum almost horizontal but slightly reflexed at apex, nearly as long as carapace, much surpassing scaphocerite, upper border armed with 13 equidistant teeth, posterior 3 of them situated on carapace; lower border somewhat convex and provided with 3 teeth (Fig. 11, *A*). Eyes moderate, with somewhat kidney-shaped cornea which is about half the stalk longitudinally; ocular spot rather small (Fig. 11, *B*). First leg a little beyond

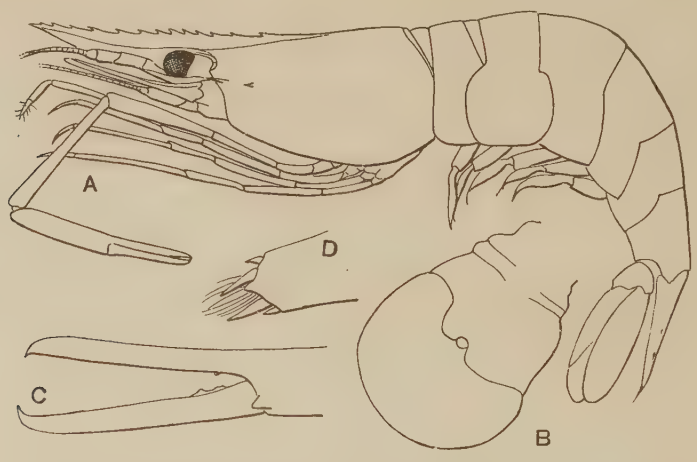


Fig. 11. *Palaemon sundaicus,* ♂, 42 mm long without rostrum, procured from Tainan, Formosa. *A,* lateral view, × ca. 2; *B,* upper aspect of eye, × ca. 10; *C,* right chela of second pereiopod, × 6; *D,* tip of telson, × ca. 10.

the tip of rostrum. Second leg symmetrical, about 0.9 times as long as body, proportions against finger: carpus 0.8, merus 0.6, ischium 0.4; movable finger with two tubercular teeth at proximal one-fifth of cutting edge; fixed one bears a tubercular tooth opposite the proximal tooth of the former (Fig. 11, *C*). Third and fourth ambulatory legs a little longer than half of body. Fifth one somewhat longer than preceding two legs and more or less longer than half of body.

The above description is based on a male specimen measuring 42.0 mm long, collected from Tainan, Formosa. Besides, 9 males, 14.0~42.0 mm in body length and 14 females, ranging 14.0~28.2 mm long, secured by Dr. Densaburô Miyazi and Mr. Ukyô Oo, were also examined.

Localities: Kotôhi, South Formosa (Dr. D. Miyadi); Tainan, Formosa (Mr. Ukyô Oo).

Distribution: Java (Heller); Flores, Celebes (de Man); Philippine (Cowles, Estampador); Tale Sap near Singgora (Kemp); Amoy (Yü); Sunda (Roux).

Note: The number of rostral spines varies from 12 to 16 on the upper border and from 2 to 4 on the lower. The upper aspect of the eye of the present species much resembles that of *P. nipponensis*, but the corneal region is somewhat thicker than that of the latter species.

Palaemon riukiuensis sp. nov.

(Pl. 1, B and Text-figs. 12~13)

Rostrum lanceolate in profile, about 0.8 times as long as carapace, well beyond antennular peduncle, upper border sub-horizontal or very slightly

Fig. 12. *Palaemon riukiuensis*, ♂, collected from Okinawa-zima, Riu Kiu.

convex; dorsal carina arising near the middle of carapace, with 12~16 teeth, posterior 3 or 4 of them situated on carapace; lower border provided with 2~4 spines (Fig. 12). Pleura mostly resemble those of *P. nipponensis*. Telson shorter than uropods, nearly oblong in outline, narrowing posteriorly until it is two-fifths the width of the proximal border and then suddenly acuminated at tip, armed along each dorso-lateral margin with one spinule at middle and one spinule at distal one-fourth; distal margin provided with two pairs of inner longer and outer shorter bristles (about half as long as inner one) (Fig. 13, *D*). Eyes rather large, inverted pear-shaped; cornea reniform, about half the stalk; ocular spot rather large (Fig. 13, *A*). Mouth-parts closely allied to those of all the above mentioned species. First cheliped slender, a little longer than half of body. Second one symmetrical, about 0.8 times as long as body; movable finger and palm equal in length; chela more or less longer than carpus; both merus and ischium subequal in length but shorter than carpus; fingers with inturned tips and straight toothless cutting edges (Fig. 13, *B* and *C*). Third leg slender, somewhat longer than first cheliped. Remaining two pairs of legs similar to third one in general aspects.

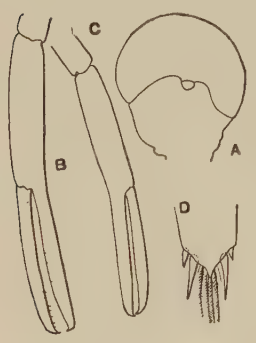


Fig .13. *Palaemon riukiuensis*, ♂, 42 mm long. *A*, upper aspect of eye, ×7; *B*, larger chela of second pereipod, ×4; *C*, smaller chela of the same, ×4; *D*, tip of telson, ×10.

Type locality: Okinawa-zima (Riu-Kiu).

Type specimen: male, 42.0 mm in body length.

Paratopotype: five males, 32.0~50.0 mm.

All specimens collected by Dr. Yaichirô OKADA and Mr. Isamu HORAZAWA.

The present species is closely related to *P. sundaicus* HELLER, *P. equidens* DANA and *P. disper* MARTENS. But it is seperable from *P. sundaicus* in having: (1) rostrum neither surpassing the tip of the scaphocerite nor reflexed at the apex; (2) eyes rather broad in upper aspect and a little larger ocular spot; and (3) second chela without tooth on the prehensile edges. It differs from *P. equidens* in the shorter rostrum which does not surpass the tip of the scaphocerite and in the wider interval between the last and the penultimate teeth on the median carina of the carapace. The rostral characters separate this species also from *P. dispar*.

Palaemon lar Fabricius

(Pl. 2, A~C and Text-fig. 14)

Palaemon lar, Ortmann, 1891, 5, p. 724; Miyake, 1938, p. 110; Estampador, 1937, p. 488.
Palaemon (Eupalaemon) lar, de Man, 1892, p. 445; Roux, 1929, p. 236; 1932, p. 565; 1934, p. 531; 1934a, p. 217.
Palaemon ornatus, Milne-Edwards, 1837, p. 396; de Man, 1879, p. 168.
Palaemon vagus, Heller, 1865, p. 417, taf. II, figs. 42 and 43.
Palaemon spectabilis, Heller, 1865, p. 113, taf. 10, fig. 8.
Palaemon ruber, (Hess, 1865, p. 39, taf. 7, fig. 20.); de Man, 1887, p. 710; Ortmann, 1891, p. 705, taf. 47, fig. 3.
Bithynis lar Bate, 1888, p. 789, pl. 129, fig. 1.
Macrobrachium lar, Maki and Tutiya, 1923, p. 56, pl. 5, fig. 1.

Rostrum rather shallow, about half as long as carapace, slightly descending, a little reflexed at tip, reaches to or somewhat beyond antennular peduncle, but not to apex of scaphocerite; dorsal carina arising a little before the middle of carapace, with 7~9 spines, lower border convex, with 2~4 spines. Telson shorter than uropods, about 6 times as long as wide across postero-lateral angles, proportions of proximal breadth to distal one 2.3:1, dorso-lateral and terminal margins armed with two pairs of bristles respectively in such manner as in *P. nipponensis*, furnished with a median tuft of hairs near proximal border (Fig. 14, *B*). Eye somewhat small, half covered with cornea, ocular spot small (Fig. 14, *A*). First leg very slender, about half times as long as body. Second leg conspicuously stout and large, symmetrical, finely tuberculated on whole surface, about 1.0~1.5 times as long as body, proportions to fingers: palm 1.3 in male, 1.2 in female; carpus 0.8, ♂, 1.0, ♀; merus 0.9, ♂, 0.9~1.2, ♀; ischium 0.4, ♂, 0.8~1.2, ♀; fingers strongly curved inwards, movable one provided with a prominent sharp tooth near the middle of cutting edge, immovable finger with one prominent tooth and one or several smaller teeth situated more proximally on the opposite edge. Third, fourth and fifth legs subequal in size and general aspects, about half times as long as body, much shorter than first leg. Endopodite of second pleopod bears shorter stylamblys in male and female and longer appendix mesculina coated thickly with hairs on inner border in male as in *P. nippon-*

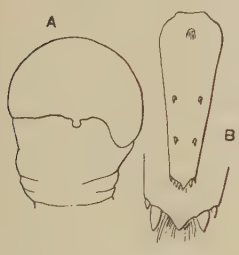


Fig. 14. *Palaemon lar*, ♂, 128 mm in body length, obtained from Okinawa-zima, Riu Kiu. *A*, upper aspect of eye, ×4; *B*, telson (×ca. 1.3) and its tip (×4).

ensis, P. longipes, P. sundaicus and *P. philippiensis.*

The above mentioned description is based on 7 male specimens, ranging from 59.0 to 110.0 mm in body length and 12 female specimens, 40.5~97.0 mm in body length, collected from the following localities.

Localities: Kimmura, Okinawa-zima; Sirakawa, Miyako-zima, collected by Dr. Yaichirô OKADA, Mr. Isamu HORAZAWA and Mr. Heizi IKEDA: Hirakawa, Isigaki-zima; Iriomote-zima, collected by Mr. Sadayosi MIYAKE: Palau Isl., collected by Mr. Itinosuke OKUKAWA.

Distribution: Amboine (MILNE-EDWARDS); Celebes, Saleyer, Flores, Adonara, Rotti Isl., Timor (DE MAN); Tahiti, Fuji Isl., Pasananca, Mindanao, near Samboangan, Philippine, Banda Isl. (BATE); Philippine (COWLES); Formosa (MAKI and TUTIYA); Sunda, Madagascar; Nouvelle-Bretagne, N.-Irlande; N.-Hamovre (Archipel Bismark), Manus (Archip. de L'Amirauté) (ROUX).

Note: The specimens at my disposal are quite in accord with the descriptions of BATE, DE MAN and others of the present species.

The ocular spot of the present species is the smallest of all found in the species dealt with in this paper.

Palaemon latimanus v. MARTENS

(Pl. 1, A and Text-fig. 15)

Palaemon (Macrobrachium) latimanus, DE MAN, p. 477, taf. 28, fig. 45.
Not: *Palaemon latimanus,* ORTMANN, 1891, p. 737, taf. 47, figs. 11 and 11 Z.; ESTAMPADOR, 1937, p. 489.

Rostrum short, about one-fourth as long as carapace, not reaching to tip of antenular peduncle, both dorsal and ventral borders convex in profile, slightly reflexed at tip, 3 spines on the ventral, 5 on the dorsal border, and 2 on the dorsal carina which runs for one-third of carapace (Fig. 15, *A*). Telson shorter than uropods, dorsally armed with two pairs of spinules in distal half, obtusely pointed at apex bearing two pairs of spinules, provided with a median tuft of hairs near proximal border as in *P. lar* (Fig. 15, *D* and *C*), proportions against length: 0.4 along anterior border and 0.2 along posterior border. Mouth-parts quite similar to those of *P. nipponensis.* First pair chelate, slender, a little shorter than half of body. Second pair robust, asymmetrically chelate and right larger than the other, wholly covered with fine spinules and hairs; larger cheliped about 0.7 times of body, proportions against finger: palm 1.2, carpus 0.8, merus 1.1, ischium 1.0; fingers armed proximally with several teeth along cutting edges, leaving

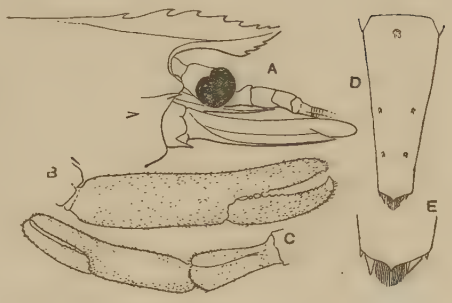


Fig. 15. *Palaemon latimanus*, ♂, 89.4 mm long, procured from Okinawa-zima, Riu Kiu. *A*, frontal aspect, ×ca. 1.3; *B*, larger hand of second pereiopod, ×ca. 1.3; *C*, smaller hand of the same pereiopod, ×ca. 1.6; *D*, telson, ×2; *E*, tip of telson, ×4.

no space between them when closed, palm sub-cylindrical (Fig. 15, *B* and *C*); smaller hand closely resembles larger one in general aspects, but no tooth in fixed finger (Fig. 15, *C*). Third, fourth and fifth legs stout, somewhat shorter than body. Endopodite of second abdominal appendage carries a shorter stylamblys and a longer appendix musculina coated with thickly set hairs on inner border.

Described from a male specimen measuring 89.4 mm long, obtained from Genka, Hanegi-mura, Okinawa-zima by Dr. Yaichirô Okada and others in April, 1935.

Distribution: Philippines; Loquilocum and Samar Island (v. Martens); Rotti; Timor, Flores (de Man).

Note: The specimen at my disposal shows some discrepancies from de Man's *P. latimanus* in having (1) both cutting edges of larger hand of second cheliped toothless at least in the distal half, and (2) fixed finger of smaller hand of the same cheliped toothless at all.

Interrelationship

Geographical distribution of the species dealt with in this paper warrants one to recognize two groups, viz., temperate and tropical. The temperate group is represented by *Palaemon nipponensis* which inhabits temperate region only. The tropical group consists of those which are mainly found in the tropics and sometimes in subtropical regions. To give the members, *Palaemon lar*, *P. sundaicus*, *P. philippinensis*, *P. riukiuensis*, *P. grandimanus*, *P. latimanus* and *P. boninensis* are exclusively found in the tropics, but *P. longipes* and *P. japonicus* spread over tropical and subtropical waters.

To elucidate more minutely interrelationship of these species respectively, enumeration of every character was first tried in each, and frequency

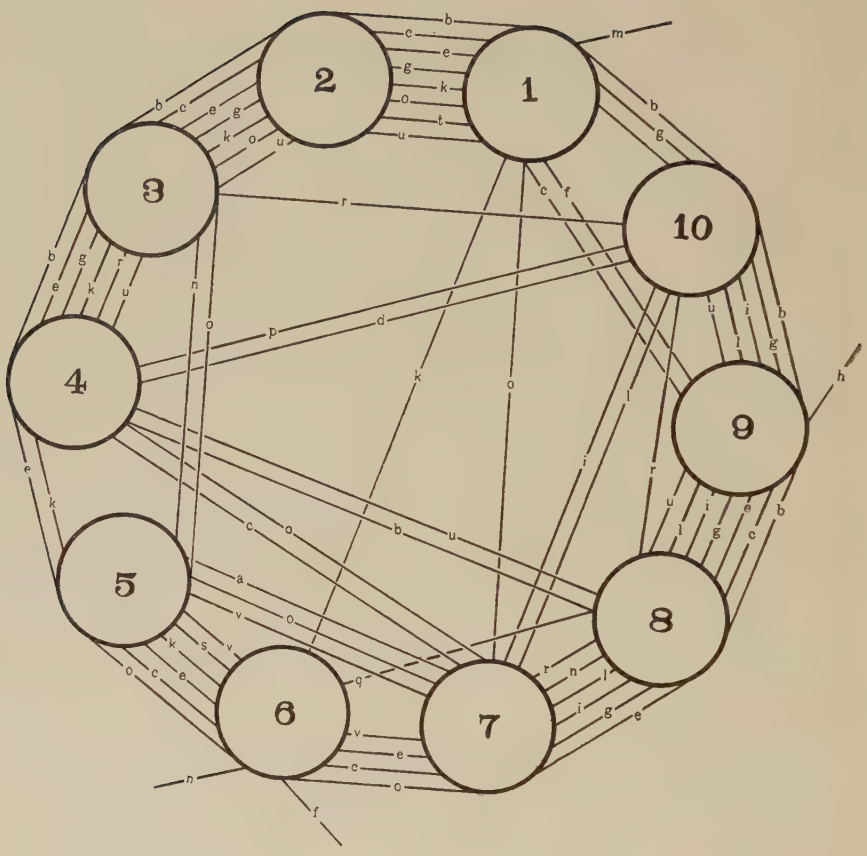


Fig. 16. *a*, upper border of rostrum almost horizontal; *b*, upper border of rostrum a little convexed; *c*, number of upper rostral spine >10; *d*, number of upper rostral spine <10; *e*, the tip of rostrum ends at the same level or a little surpassed the level of the first antenual peduncle; *f*, second cheliped smooth; *g*, second cheliped covered with thickly set setae; *h*, second cheliped covered with sparsely set setae; *i*, second cheliped asymmetrical; *k*, palm of second cheliped with subcircular cross-section; *l*, the same segment as in *k* with oval cross-section; *m*, fingers of second cheliped hairy; *n*, no tooth on the prehensile edges of second cheliped; *o*, merus shorter than carpus in the second cheliped; *p*, merus longer than carpus in the second cheliped; *q*, merus as long as carpus in the second cheliped; *r*, carpus shorter than palm in the second cheliped; *s*, carpus longer than palm in the second cheliped; *t*, carpus as long as palm in the second cheliped; *u*, finger shorter than palm in the second cheliped; *v*, finger as long as palm in the second cheliped; 1, *P. nipponensis;* 2, *P. philippinensis;* 3, *P. longipes;* 4, *P. lar;* 5, *P. sundaicus;* 6. *P. riukiuensis;* 7, *P. grandimanus;* 8, *P. japonicus;* 9, *P. boninensis;* 10, *P. latimanus.*

of each was noted down as shown in Table 3. It may be argued that there must exist relative importance of the characters in question so that mere counting would be of no value. Inasmuch as it does not appear to warrant one to adopt any scheme for the time being, I must confine myself to take things as they really count. Frequency of coincidence is thus given in the table and graphically represented in Fig. 16, by way of drawing a line as a coincidence takes place at each time.

Taking apparent value of the frequency for granted, three groups may be established in the degree of interrelationship. The common and remark-

Table 3.

Frequency of coincidence of characters in the species of *Palaemon*.

(A)(B) 8								
(A)(C) 7	(B)(C) 7							
(A)(D) 5	(B)(D) 5	(C)(D) 6						
(A)(E) 4	(B)(E) 4	(C)(E) 4	(D)(E) 2					
(A)(F) 2	(B)(F) 2	(C)(F) 2	(D)(F) 1	(E)(F) 5				
(A)(G) 4	(B)(G) 4	(C)(G) 5	(D)(G) 3	(E)(G) 5	(F)(G) 4			
(A)(H) 5	(B)(H) 5	(C)(H) 6	(D)(H) 5	(E)(H) 2	(F)(H) 3	(G)(H) 6		
(A)(I) 4	(B)(I) 5	(C)(I) 5	(D)(I) 4	(E)(I) 2	(F)(I) 2	(G)(I) 5	(H)(I) 7	
(A)(J) 3	(B)(J) 3	(C)(J) 4	(D)(J) 6	(E)(J) 0	(F)(J) 0	(G)(J) 4	(H)(J) 5	(I)(J) 5

A, *P. nipponensis*; B, *P. philippinensis*; C, *P. longipes*; D, *P. lar*; E, *P. sundaicus*; F, *P. riukiuensis*; G, *P. grandimanus*; H, *P. japonicus*; I, *P. boninensis*; J, *P. latimanus*.

able character in the first group is possession of the slender second cheliped, whereas the stout second cheliped in the second group, and small body-build in the third. The first consists of *P. nipponensis, P. philippinensis, P. longipes* and *P. lar;* the second *P. japonicus, P. grandimanus, P. boninensis* and *P. latimanus;* and the third *P. sundaicus* and *P. riukiuensis.*

It is hoped that any evidence from developmental or physiological side whatever will test the validity of the classification here given.

Literature

1. Balss, H., 1914: Ostasiatische Decapoden, II. Die Natantia und Reptantia. Abhandl. der math.-phys. Klasse der K. Bayer. Akad. der Wissenschaften II. Suppl. **10**, Abhandlg.
2. ——, 1924: Ostasiatische Decapoden V. Die Oxyrhynchen und Schlussteil. Archiv für Naturgeschichte, Heft 5.

3. BATE, S., 1888: Report of the scientific results of the exploring voyage of H.M.S. Challenger, **24**.
4. ——, 1968: On a new genus with four new species of fresh water prawns. Proc. Zool. Soc. London.
5. BOONE, L., 1931: A collection of Anomuran from the fresh waters of the canal zone. Bull. Amer. Mus. Nat. Hist., 63.
6. BORRADAILE, L. A., 1917: The Percy Sladen trust expedition to the Indian Ocean in 1905 under the leadership of Mr. J. Stanley Gardiner. Trans. Linn. Soc. Ser. 2, Zool., **17**.
7. COWLES, R. P., 1914: Palaemons of the Philippine Islands. Philipp. Jour. Sci. Manila, **9**.
8. DANA, James D., 1852: Crustacea of the U. S. exploring expedition, **13**, Philadelphia.
9. ESTAMPADOR, Eulogio P., 1937: A chek list of Philippine Crustacean Decapod. Philippine Jour Sci., **62** (4).
10. DE HAAN, W., 1850: Fauna Japonica (Crustacea).
11. HAY, W. P. und C. A. SHORE, 1916: The decapod crustaceans of Beaufort, N. C., and the surrounding region. Bull. U. S. Bureau Fisheries, **35**.
12. HELLER, C., 1856: Zur Fauna der Adria. Verhandl. Zool.-Botan. Gesellsch., Wien.
13. ——, 1862: Beiträge zur näheren Kentniss der Macruren. Sitzungsberichte der Mathematische-Naturwiss. Classe der Wiss., **45**, Abhandlung. 1.
14. ——, 1865: Reise "Novara" Exped., Crust.
15. HENDERSON, J. R., 1893: A contribution to Indian carcinology. Trans. Linn. Soc. London, **5**.
16. KEMP, S., 1915: Fauna of the Chilka Lake. Crustacea Decapoda. Mem. Ind. Mus., **5**.
17. ——, 1918: Zoological results of a tour in the Far East (Decapod and Stomatopod Crustacea), Men. Asiat. Soc. Bengal, **6**.
18. ——, 1924: Crustacea Decapoda of the Sijn Cave' Garo hills, Asam. Rec. Ind. Mus., **26**.
19. KUBO, I., 1937: Sexual dimorphism in abdominal appendges of some Palaemonoid shrimps of Japan. Bull. Japan. Soc. Sci. Fisheries, **5** (6).
20. LEACH, W. E., 1815: A tabular view of the external characters of four classes of animals (Crustacea). Trans. Linn. Soc. London, **11**.
21. MAKI, M. and H. TUTIYA, 1923: Figures and descriptions of Formosan decapod crustacea (in Japanese). Bull. Taiwan Sôtokuhu Tyûô Kenkyû-zyo, No. 3.
22. DE MAN, J. G., 1876: On some species of the genus *Palaemon* Fabr. with descriptions of two new forms. Notes from the Leyden Mus., **1**.
23. ——, 1888: Report on the Podophthalmous Crustacea of the Mergui Archipelago, collected for the Trustees of the Indian Museum (Macrura). Jour. Linn. Soc. London.
24. ——, 1892. Decapoden des Indischen Archipels. Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien herausgegeben von Max Weber. Bd. II.
25. ——, 1915: Zur Fauna von Nord Neuginea. Nach den Sammlungen von Dr. P. N. von Kampen und K. Gjellerup in den Jahren 1910—1911. Macrura. Zool. Jahrb. Syst. **38**.
26. ——, 1925: Contribution à l'étude des Décapodes macroures marins et fluviatiles du bassin du Congo. Amer. Mus. Congo. Tervueren Zool. Ser. 3, Sect. 3, fasc. 1.
27. MIERS, E. J., 1877: On a collection of Crustacea Decapoda and Isopoda, chiefly from

South America, with descriptions of new genera and species. Proc. Zool. Soc. London.

28. ——, 1880: On a collection of Crustacea from the Malaysian region. Ann. Mag. Nat. Hist., (5), **5**.
29. Milne-Edwards, H., 1837: Histoire Naturelle des Crustacés, **2**.
30. Miyake, S., 1938: Notes on Decapod Crustaceans collected by Prof. Teisô Esaki from Micronesia. Annot. Zool. Japonenses, **17** (2).
31. Ortmann, A., 1890: Die Decapoden-Krebse des Strassburger Museums. Zoolog. Jahrb., **5**.
32. Parisi, B., 1919: I Decapodi Giapponesi del Museo di Milano. VII. Natantia. Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale in Milano, **58**, Fasc. 1.
33. Pesta, O., 1931: Crustacea Decapoda aus Costa Rica. Ergeb. Österreich. Biol. Costa-Rica exped. 1930. Ann. naturh. Mus. Wien, **45**.
34. Rathbun, M. J., 1902: Japanese stalk-eyed Crustaceans. Proc. U. S. Nat. Mus., **24** (1307).
35. ——, 1902: Investigations of the aquatic resources and fisheries of Porto Rico (Brachyura and Macrura). Bull. U. S. Fish Comm., **20**, (for 1900).
36. ——, 1906: Brachyura and Macrura of Hawaiian Islands. Bull. U. S. Fish Comm. (for 1903), **23**. Part 3.
37. ——, 1935: Scientific results of an expedition to rain forest regions in Eastern Africa. 2. Crustacea. Bull. Mus. Comp. Zool., **79** (2).
38. Bedeke, H. C., 1937. Über die Verbreitung einiger Malakostraken in niederländischen Gewässern. Internationale Revue, **35**.
39. Roux, J., 1917: Crustacés (Expédition de 1903). Nova Guinea. Résultats de l'expédition scientifique à la Nouvelle Guinea, **5** (589~621).
40. ——, 1919: Süsswasserdekapoden von den Aru- und Kei-Inseln. Frankurt a. M. Abh. Senckenb. Ges., **35**.
41. ——, 1921: Crustacés in Herderschee. A. F. Nova Guinea Leiden, **13**.
42. ——, 1923: Crustacés d'eau douce de l'archipel Indo-Australien. Capita Zool.'s Gravenhage, **2**.
43. ——, 1926: Crustacés décapodes d'eau douce de la Nouvelle-Calédonieen. Nova Caledonia München Zool., **4**.
44. ——, 1927: Contribution à la faune Carcinologique d'eau douce de la Nouvelle-Guinée. Nova Guinea, **15**. livr. 3.
45. ——, 1928: Notes sur deux espèces sud-americaines de Crustacés Macrures d'eau douce. Revue Suisse de Zoologie, **35** (4).
46. ——, 1929: Süsswasserdekapoden von den Sunda-Inseln, gesammelt durch die Sunda-Expedition Reuch. Sitzungsberichte der Gesellschaft naturforschenden Freunde.
47. ——, 1930: Note sur quelques Crustacés decapodes dulçaquicoles de l'Archipel into-australien. Revue Suisse de Zoologie, **37**.
48. ——, 1931: Crustacés Decapodes d'eau douce de l'Inde méridionale. Rev. Suisse Zool. Genève, **38**.
49. ——, 1932: Süsswassermacruren der deutschen limnologischen Sunda-Expedition. Archiv für Hydrobiologie, Suppl.-Bd. **11**. "Tropische Binnengewässer, Bd. III."
50. ——, 1933: Crustacés Decapodes d'eau douce. Résaltats scientifiques du Voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse

Léopold de Belgique. Mém. Mus. Roy. Hist. Nat. de Belgique, Hors série **3** (14).
51. ——, 1933: Note sur quelques Crustaés décapodes d'eau douce provenant de l'Australie septentrionale. Revue Suisse de Zoologie, **40** (24).
52. ——, 1934: Notes de Carcinologie mélanésienne, I. Décapodes d'eau douce de l'Archipel Bismarck et des Iles de L'Amirauté. Revue Suisse de Zoologie, **41** (11).
53. ——, 1934: Macrures d'eau douce de Madagascar et des îles voisines (Palémonidés et Atydés). Faune des Colonies Françaises, **5**, Fasc. 8.
54. ——, 1934: New freshwater decapod crustaceans from the Malay Peninsula. Bull. Raffles Mus., **9**.
55. ——, 1935: Voyage de Ch. Alluaud et P.A. Chappuis en Afrique Occidentale Française (1930~1931), 7. Crustacés decapodes d'eau douce. Archiv für Hydrobiologie, **38**.
56. SCHMITT, W. L., 1921: The marine decapod crustacea of California. Univ. Califor. Pub. Zoolg., **23**.
57. ——, 1926: The Macrura, Anomura and Stomatopod crustaceans collected by the American Museum Congo expedition, 1909~1915. Bull. Amer. Mus. Nat. Hist. New York, **53**.
58. STEBBING, T. R. R., 1915: South African crustacea (Part VIII of S. A. Crustacea, for the Marine in South Africa.) Cape Town Ann. S. Afric. Mus., **15**.
59. STIMPSON, W., 1860: Prodromus descriptionis animalium evertebratorum expeditionis ad oceanum pacificum septentrionalem. Proc. Acad. Nat. Sci. Philodelphia.
60. YU, S. C., 1931: Notes sur les crevettes chinoises appartenant au genre *Palaemon* Fabr. avec description de nouvelles espèces. Bulletin de la Société Zoologique de la Société Zoologique de France, **56** (3).
61. ——, 1936: Notes on new fresh-water prawns of the genus *Palaemon* from Yunnan. Bull. Fan Mem. Inst. Biology, **6** (6).

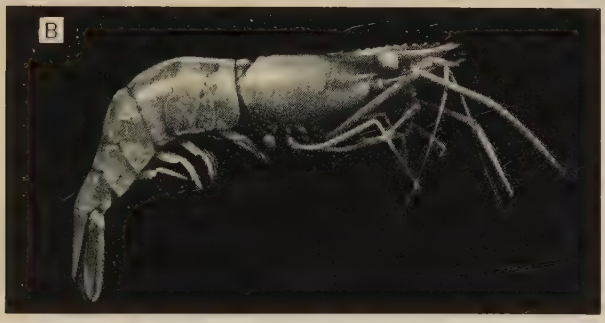
Explanation of Plate I

Fig. A. *Palaemon latimanus* v. MARTENS, ♂, ×ca. 0.75.
Fig. B. *Palaemon riukiuensis* sp. nov. ♂, ×ca. 1.
Fig. C. *Palaemon grandimanus* DANA, ♂, ×ca. 1.
Fig. D. Second pereiopod of grown up male, ×ca. 0.6.
Upper, *P. philippinensis* COWLES; middle, *P. longipes* DE HAAN; lower, *P. nipponensis* DE HAAN.

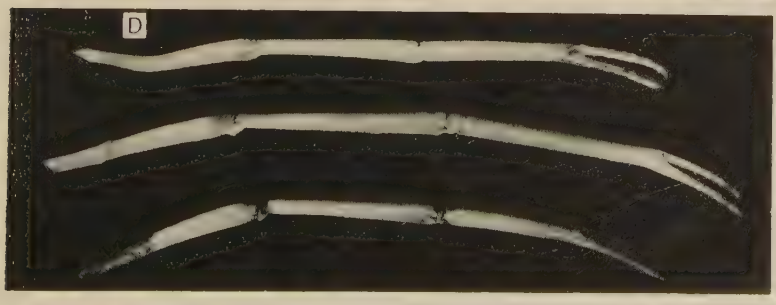
Explanation of Plate II

Fig. A and B. *Palaemon lar* FABRICIUS, ♂, ×ca. 0.7 and its second chelipeds, ×ca. 0.6.
Fig. C. *Palaemon lar* FABRICIUS, ♀, ×1.
Fig. D. *Palaemon japonicus* DE HAAN, ♂, ×ca. 0.53.

A


B

C


D

Studies on Japanese Palaemonoid Shrimps
II. Pontoniinae[1]

Ituo Kubo

(Received April 16th, 1940)

Various authors have studied Japanese shrimps since de Haan (1850), but the knowledge concerning the fauna of Japanese Pontoniidae is very meagre. The scrutiny of the material from Pacific coasts of Honsyû, Riû-Kiû Islands, Bonin Islands and Oceania, with special reference to the features of mouth-parts, however, enabled the writer to make some emendations and additions to the taxonomy of this subfamily.

The material at my disposal are referable to six genera, *Anchistus, Conchodytes, Coralliocaris, Harpilius, Periclimenes* and *Pontonia* and to fourteen species, four of which, viz., *Periclimenes*(*Periclimenes*) *curvirostris*, *Periclimenes*(*Ancylocaris*) *gracilirostris*, *Periclimenes*(*Ancylocaris*) *amamiensis* and *Pontonia Katoi* are erected as new to science.

Before proceeding any further, hearty thanks are extended to Dr. Arata Terao, under whose kind supervision the present study was carried out. Acknowledgment is also made to Messrs. S. Saitô, R. Wada, K. Katô, S. Miyake and G. Abe for their assistance rendered in obtaining the material.

Subfamily PONTONIINAE Kingsley

Key to the genera of Pontoniinae

A. Dactylus of last three legs simple or biunguiculate, but without basal protuberance nor seration

B. Carapace not depressed ..... ***Periclimenes.***

B′. Carapace slightly depressed

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In the present work, the length of body is indicated by a measurement from the posterior margin of orbital notch to the distal margin of telson; the length of carapace is represented by the distance between post-orbital and posterior margins.

c. Rostrum not acute at apex, toothless or toothed at apex only ..... ***Anchistus.***
c′. Rostrum acute at apex, toothed dorsally and ventrally ..... ***Harpilius.***
A′. Dactylus of last three legs with basal protuberance or serration
D. Rostrum depressed, toothless
E. Inner lacinia of maxillule narrow, dactylus of last three legs without basal protuberance ..... ***Pontonia.***
E′. Inner lacinia of maxillule very broad, dactylus of last three legs with basal protuberance ..... ***Conchodytes.***
D′. Rostrum thin, laterally compressed, toothed dorsally and ventrally; inner lacinia of maxillule slender ..... ***Coralliocaris.***

Genus ***Periclimenes*** COSTA

Periclimenes, BORRADAILE, 1917, p. 357; PESTA, 1918, p. 123; KEMP, 1922, p. 134; RATHBUN, 1902, p. 121.
Anchistia, DANA, 1852, p. 577.
Urocaris, STIMPSON, 1860, p. 39; BORRADAILE, 1917, p. 353.

Body somewhat laterally compressed. Carapace usually provided with lanceolate and toothed rostrum as well as antennal spine. Hepatic spine present or absent. Sixth abdominal segment moderate in length. Telson shorter than uropods. Abdominal pleura from first to fifth rounded on inferior margin. Eyes moderate and well-pigmented. Mandible without palp. Maxillule with narrow inner lacinia and usually provided with rather developed apical lobe on distal border of endopodite. Inner distal endite of maxilla usually consists of two slender lobes provided with long setae on its distal border. All maxillipeds with exopodite and mastigobranchia. First maxilliped provided with lamella on basal outer margin of exopodite.

Third maxilliped stout, usually pediform. First and second pairs of pereiopods with chela, the latter pair much larger than the former. Last three pairs of legs somewhat stouter and longer than first one, and dactylopodite of these legs simple or biunguiculate but without basal protuberance.

Note: The present genus exhibits much resemblance to two genera, viz., *Harpilius* DANA and *Anchistus* BORRADAILE in general aspects, but it is easily separated from the former by having the following remarkable characters:—(1) body is laterally compressed, (2) maxilla is provided with inner distal lacina, (3) inner endite of the maxillule is more or less narrow, and from the latter by having such characters as: (1) body laterally compressed; (2) rostrum acute at apex.

According to KEMP (1922, p. 137), the present genus should be divided into three subgenera, namely, *Periclimenes*, *Periclimenaeus* and *Ancylocaris*, and they are characterized as in the following key:—

A. Dactylus of last three pereiopods biunguiculate
  B. Hepatic spine present ..... ***Periclimenes.***
  B′. Hepatic spine absent ..... ***Periclimenaeus.***
A′. Dactylus of last three pereiopods simple, hepatic spine usually present.... ***Ancylocaris.***

Subgenus ***Periclimenes*** sensu stricto

Periclimenes, Kemp. 1922, p. 139.

No species of this subgenus has been known from Japan. But for the first time two species, viz., *P.* (*Periclimenes*) *alcocki* Kemp and *P.* (*Periclimenes*) *curvirostris* sp. nov. are recorded here. The specimens representing this subgenus were secured by trawl net off Mie Prefecture at a depth of about 170 fathoms.

Key to the species of the subgenus *Periclimenes*

A. Rostrum subhorizontal; eye comparatively small; dorso-lateral margins of telson armed with four pairs of bristles ..... ***P. alcocki.***
A′. Rostrum directed evidently downwards; eye large; dorso-lateral margins of telson armed with two pairs of bristles ..... ***P. curvirostris* sp. nov.**

Periclimenes (Periclimenes) alcocki Kemp

(Figs. 1–2)

Periclimenes (*Periclimenes*) *alcocki*, Kemp, 1922, p. 154, text-figs. 21–24.
Palaemon (*Brachycarpus*) *laccadivensis*, Alcock, p. 138.

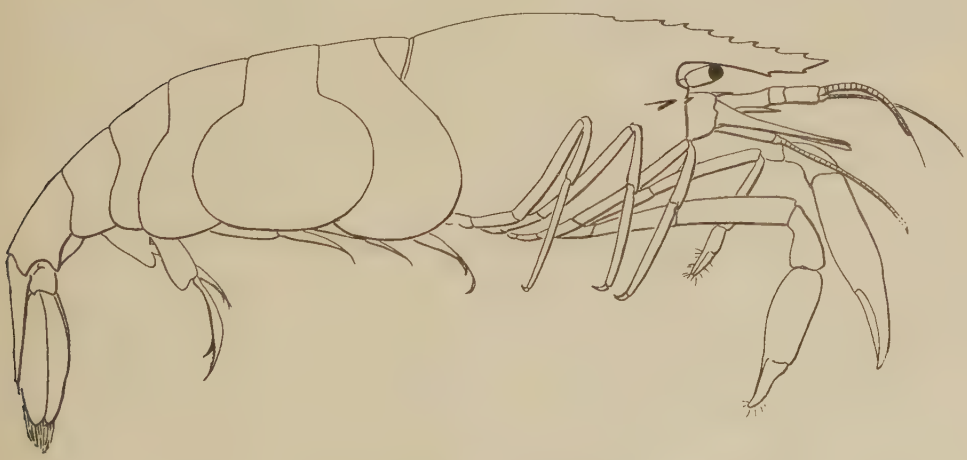

Fig. 1. *Periclimenes* (*Periclimenes*) *alcocki* Kemp, ♀, ×3.

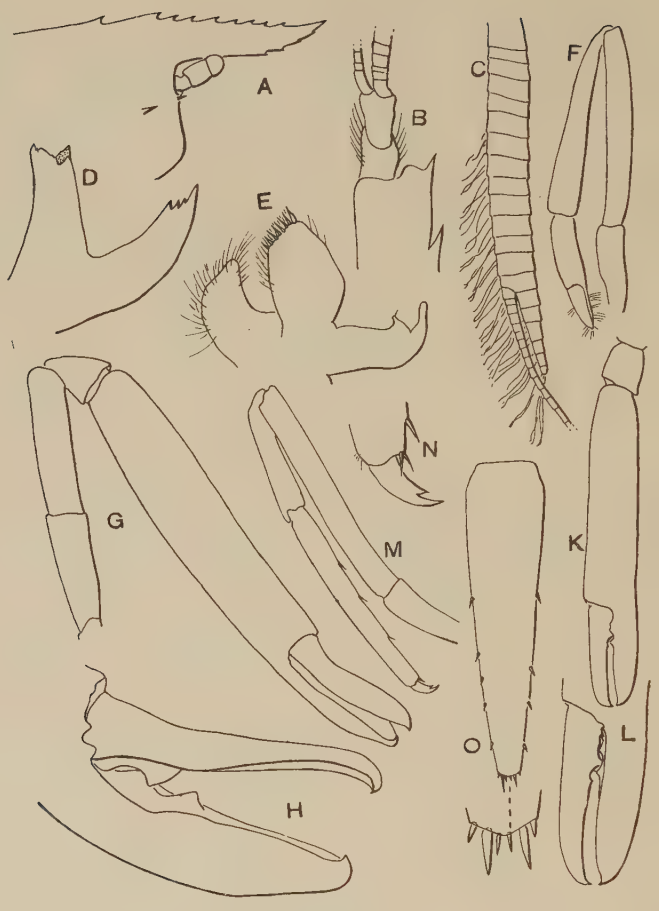

Fig. 2. Body parts of *Periclimenes* (*Periclimenes*) *alcocki* KEMP, ♀. *A*, rostrum; *B*, antennular peduncle, × 6; *C*, outer flagellum of antennule, × ca. 10; *D*, mandible, × 20; *E*, maxillule, × 20; *F*, first pereiopod, × 6; *G*, larger leg of second pair of pereiopod, × 2.5; *H*, fingers of the same leg as in *G* (outer view), × 6; *K*, smaller leg of the same pair as in *G*, × 2.5; *L*, fingers of the same leg as in *K*, × 6; *M*, third pereiopod, × 6; *N*, dactylus of third leg, × 20; *O*, telson, × 6.

Mandible Y-shaped, without palp, incisor process compressed, armed with four teeth along distal margin (Fig. 2, *D*). Inner lacinia of maxillule rather broad; endopodite with well-developed thumb-like apical lobe (Fig. 2, *E*). Distal inner endite of maxilla consists of two slender lobes. All three maxillipeds provided with long exopodite.

Branchial arrangement runs as follows:—

	I	II	III	IV	V	VI	VII	VIII
Pleurobranchiae	—	—	—	1	1	1	1	1
Arthrobranchiae	—	—	—	—	—	—	—	—
Podobranchiae	—	—	r	—	—	—	—	—
Mastigobranchiae	2	1	1	—	—	—	—	—

Four ovigerous female specimens measuring from 33.5 to 44.0 mm in body length were obtained from Kumano-nada of Owase, Mie Prefecture at a depth of about 170 fathoms by Mr. G. Abe on April 5th, 1937.

Distribution: Laccadive Sea, 406 fathoms (Kemp).

Note: The spines on the upper border of rostrum ranges from 8 to 10 in number, while those on the lower border 2 to 4 in my specimens. The mouth-parts closely resemble those of other species belonging to this genus. But the two characters, that (1) the second thoracic leg is closely covered throughout with setae, and (2) that the doroso-lateral margins of telson are provided with four pairs of bristles separate the present species from any other of this genus, and they are unique in the whole subfamily Pontoniinae.

Periclimenes* (*Periclimenes*) *curvirostris sp. nov.

(Figs. 3~5)

Body smooth. Rostrum lanciform, deep, remarkably curved downwards, dorsal carina extending backwards to middle of carapace; upper border bears 8 spines, the hindmost one situated a little behind the level of orbit; lower border with 2 subterminal teeth (Fig. 3). Infra-orbital angle pointed. Antennal spine placed close to infra-orbital angle. Hepatic spine situated

Fig. 3. *Periclimenes* (*Periclimenes*) *curvirostris* sp. nov., ♀, ×3.

a little postero-laterally to antennal one. Antero-lateral angle of carapace rounded. Abdomen with all terga rounded, first to fifth pleura rounded on their inferior margin, second pleuron overlapping first and third pleura. Telson shorter than uropods, distally gradually decreasing its width, breadth at the proximal widest region a little more than twice and half that between postero-lateral angles; each dorso-lateral margin armed with two bristles: one near its middle and the other at five-sixths; terminal margin convex, fringed with three bristles outermost one shortest, middle one longest about 3 times as olng as outermost one and innermost one somewhat shorter than middle one (Fig. 5, *G*). Eye large well-pigmented. Antennular peduncle does not reach to tip of rostrum; basal segment depressed, broad, with a large lanciform lateral spine nearly reaching to its middle, distal outer angle ends in a prominent spine; ultimate segment longer than penultimate one (about one and half times as long as penultimate segment), provided with outer thicker and inner thinner rami, the outer one proximally uniramous and five-jointed but distally bifid with inner shorter (four-jointed) and outer longer branches (Fig. 5, *A*). Mandible without palp (Fig. 4, *A*). Endopodite of maxillule with thumb-like apical lobe (Fig. 4, *B*). Maxilla carries ear-shaped scaphognathite; inner proximal endite rudimentary, distal one consists of two slender lobes bearing long setae on apical margin;

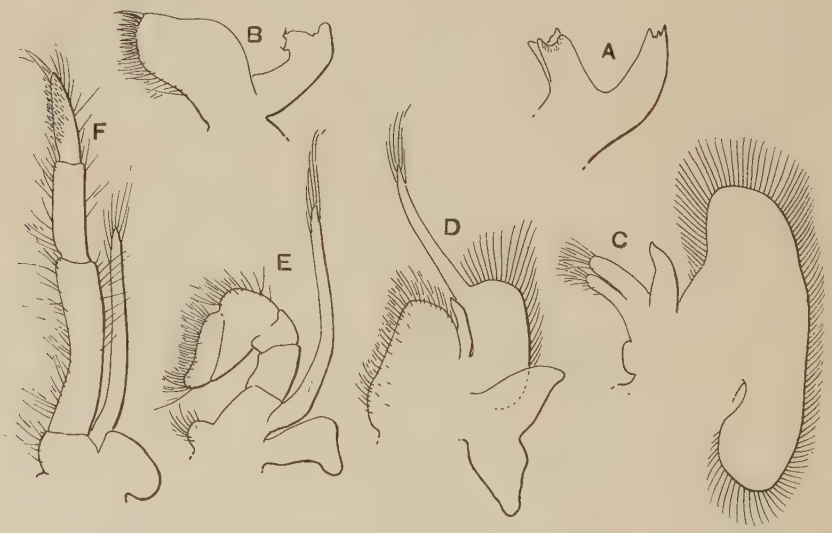

Fig. 4. Mouth-parts of *Periclimenes* (*Periclimenes*) *curvirostris* sp. nov. *A*, mandible, ×25; *B*, maxillule without inner lacinia, ×35; *C*, maxilla, ×25; *D*, first maxilliped, ×20; *E*, second maxilliped, ×20; *F*, third maxilliped, ×20.

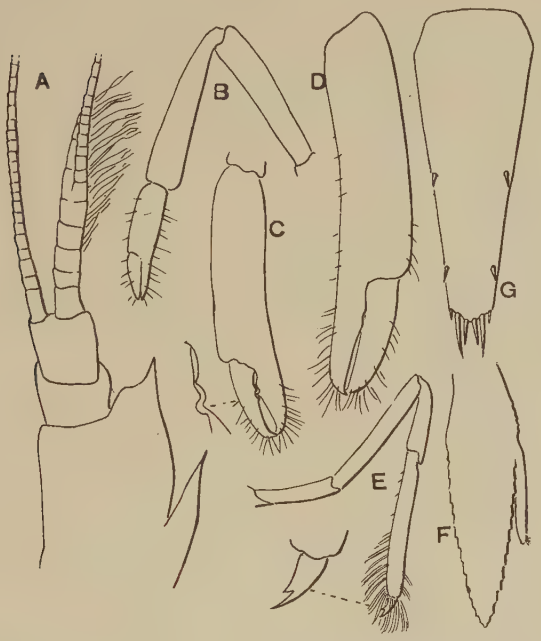

Fig. 5. *Periclimenes* (*Periclimenes*) *curvirostris* sp. nov., ♀. *A*, first antenna, ×20; *B*, first pereiopod (left), × ca. 10; *C*, second pereiopod (larger chela); *D*, same as *C* (smaller chela), × ca. 10; *E*, third leg × ca. 7; *F*, endopodite of second pleopod, ×20; *G*, telson, ×15.

endopodite papilla-like (Fig. 4, *C*). All maxillipeds with exopodite. Third maxilliped pediform, stout; ultimate and penultimate joints subequal in length; antepenult one a little more than twice as long as ultimate one, breadth at middle about one-fifth of its length (Fig. 4, *F*). First cheliped slender, ratios against movable finger: palm 1.5; carpus 3.5; merus 3.2, cutting edges of chela straight, unarmed, breadth at middle of palm about half times of its length (Fig. 5, *B*). Second chelipeds unequal in size; larger leg 2.2 times as long as carapace, proportions to movable finger: palm 2.4, carpus 0.75, merus 1.2, ischium 0.8; tips of fingers recurved inwards; both fingers armed with two small teeth a little behind the middle of their prehensile edges; palm heavy, width at its middle about two-sevenths times of length (Fig. 5, *C*); merus without strong spine on distal lower margin; smaller leg about twice as long as carapace, very similar to larger one in general aspects, proportions against movable finger: palm 2.4, carpus 0.9, merus 1.4, ischium 1.0 (Fig. 5, *D*). Posterior three pairs of thoracic legs similar. Third leg slender, about 1.6 times as long as carapace; dactylus

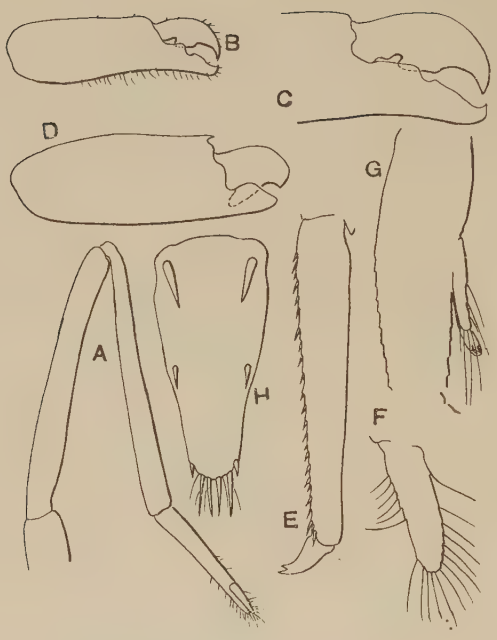

Fig. 7. Body parts of *Periclimenes* (*Periclimenaeus*) *gorgonidarum* BALSS, ♂. *A*, first pereiopod, ×15; *B*, larger chela of second pereiopod, × ca. 3; *C*, fingers of larger chela of second one, ×6; *D*, smaller chela of second pereiopod, ×6; *E*, propodus and dactylus of third pereiopod, ×15; *F*, endopodite of first pleopod, ×25; *G*, endopodite of second pleopod, ×35; *H*, telson, × ca. 10.

number of spinules along posterior border of propodus, dactylus biunguiculate (Fig. 7, *E*). Fourth and fifth legs entirely similar to third one. Endopodite of first abdominal appendage lamellar (Fig. 7, *F*). Endopodite of second pleopod carries shorter stylamblys and longer appendix musculina on proximal inner margin (Fig. 7, *G*). Telson gradually decreasing its width, each dorso-lateral margin armed with a long spine directed slightly inwards near its proximal margin and with similarly long one at half way between the proximal spine and postero-lateral angle, distal margin convex and armed with three pairs of spinules (Fig. 7, *H*).

Each of anterior three thoracic somites carries mastigobranchia only and last five somites (from fourth to eighth) with a pleurobranchia on each side as shown in the following lines:—

	I	II	III	IV	V	VI	VII	VIII
Pleurobranchiae	—	—	—	1	1	1	1	1
Arthrobranchiae	—	—	—	—	—	—	—	—
Podobranchiae	—	—		—	—	—	—	—
Mastigobranchiae	1?	1	1	—	—	—	—	—

The foregoing description is based on an ovigerous female specimen measuring 20.0 mm in body length and a male, 16.5 mm. These specimens

were fished by Mr. Takio Yokota from Hurue, Kitaura-mura, Higasiusuki-gun, Miyazaki Prefecture, at a depth of about 8 fathoms together with *Gelidium*, on August 11th, 1938.

Distribution: Misaki, Sagami Bay (Balss).

Note: The specimens at my disporsal mostly agree with Balss's description and figures. But the only point of difference is that the dactylus of pereiopods from third to fourth is serrated in his. I venture to think that the bifid tip of the fifth leg was overlooked by Balss.

Kemp (1922, p. 138) has remarked that the present species probably does not belong to the Pontoniinae, but so far as my observations go there leaves no room for doubt that it is truly a member of Pontoniinae.

Subgenus ***Ancylocaris*** Shenkel

Ancylocaris, Kemp, 1922, p. 167.

To the already recorded two species of this subgenus from Japan, *P.* (*Ancylocaris*) *hertwigi* Balss (1914, p. 49) and *P.* (*Ancylocaris*) *akiensis* Kubo (1936, p. 47), two more are here added as given in the following key.

Key to the species of the subgenus *Ancylocaris*

A. Rostrum very thin
  B. Tip of telson armed with three pairs of bristles ..... ***P. gracilirostris* sp. nov.**
  B′. Tip of telson fringed with 13 bristles ..... ***P. hertwigi.***
A′. Rostrum moderate
  C. Dactylus of last three pairs of walking legs long; distal spine of antennal scale well beyond end of lamella ..... ***P. amamiensis* sp. nov.**
  C′. Dactylus of last three pairs of walking legs comparatively short; distal spine of antennal scale does not extend beyond end of lamella ..... ***P. akiensis.***

Periclimenes* (*Ancylocaris*) *gracilirostris sp. nov.

(Figs. 8~10)

Body smooth, somewhat compressed. Carapace dorsally convex in profile, antennal spine present, hepatic and supraorbital spines absent, infraorbital angle spiniform, antero-lateral angle rounded. Rostrum very shallow, upper border slightly concave, dorsal carina arising from about midpoint of carapace, armed with almost equally spaced six spines, the hindmost of which is placed a little behind posterior border of orbital notch; lower border with two subterminal teeth (Fig. 8). Abdominal segments dorsally rounded. All pleura not pointed on inferior margin, first and third pleura overlapped by second one. Telson slightly shorter than uropods; distally

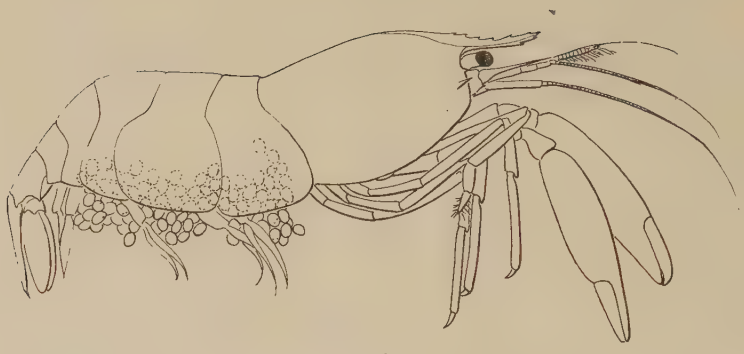

Fig. 8. *Periclimenes* (*Ancylocaris*) *gracilirostris* sp. nov., × ca. 3.

gradually decreasing its breadth almost by half, dorso-lateral margin provided with two bristles, one at middle and the other at midway between middle and distal end; terminal margin furnished with three pairs of bristles, outer and innermost small ones and middle one about thrice the length of outer one (Fig. 10, *F*). Mandible consists of molar and incisor processes, without palp (Fig. 9, *A*). Maxillule provided with rather narrow inner lacinia, recurved forwards at right angles, endopodite with well-developed apical lobe (Fig. 9, *B*). Maxilla with ear-shaped scaphognathite, endopodite bare and thumb-like, inner distal endite forked in the form of

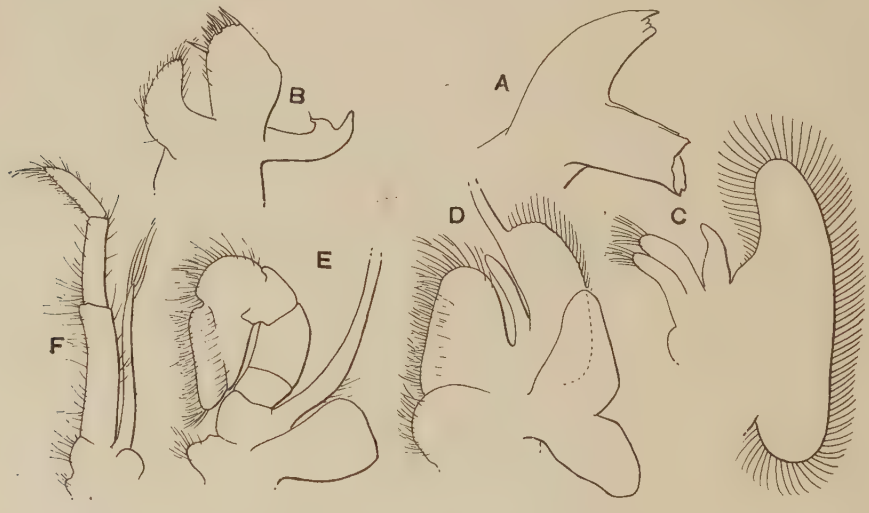

Fig. 9. Mouth-parts of *Periclimenes* (*Ancylocaris*) *gracilirostris* sp. nov. *A*, mandible, × 25; *B*, maxillule, × 25; *C*, maxilla, × 20, *D*, first maxilliped, × 20; *E*, second maxilliped, × 20; *F*, third maxilliped, × ca. 10.

two slender lobes but proximal lacinia rudimentary (Fig. 9, *C*). All three maxillipeds provided with exopodite and mastigobranchiae (Fig. 9, *D*~*F*). Third maxilliped pediform, stout; penultimate segment a little longer and antepenult one somewhat less than twice as long as ultimate one; antepenult joint about four times as long as wide (Fig. 9, *E*). Antennular peduncle reaches to tip of rostrum; basal segment depressed, distal outer angle ends in a large lanciform process reaching about distal margin of second segment; third segment somewhat longer than second one, carries inner thinner and outer thicker flagella, the latter proximally uniramous consisting of 9 joints and distally biramous with longer and shorter rami, the latter one comprising 4 joints (Fig. 10, *A*). Second chelipeds similar with each other but slightly different in size, about two times as long as carapace; fingers with inturned tips, and toothed proximally, one tooth on movable finger fitting with two teeth on fixed finger; palm two and half times as long as finger, carpus remarkably short, about one-fifth of palm; merus without spine at tip of lower border (Figs. 10, *B* and *C*). Last three pairs of thoracic legs much similar. Third leg slender, about 1.6 times as long as carapace; dactylus ends in a single claw; 11 times as long as wide, about 6 times as long as dactylus, posterior margin armed with 7 bristles; carpus and ischium subequal and about half times of propodus and merus in length, merus without spine on distal lower border (Fig. 10, *D* and *E*).

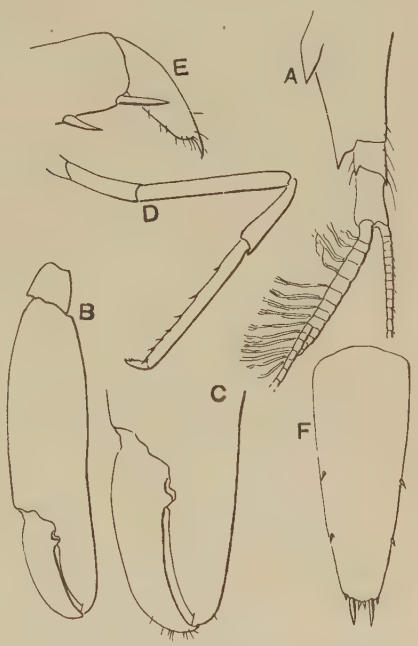

Fig. 10. Body parts of *Periclimenes* (*Ancylocaris*) *gracilirostris* sp. nov., ♀. *A*, antennule, ×ca. 10; *B*, carpus and chela of first pereiopod, ×6; *C*, fingers of pereiopod, ×ca. 10; *D*, third pereiopod, ×ca. 7; *E*, tip of third pereiopod, ×35; *F*, telson, ×ca. 10.

Type specimen: ovigerous female, measuring 23 mm long, obtained in February, 1937 by Mr. Genkiti Abe.

Type locality: Kumano-nada off Mie Prefecture at a depth of about 170 fathoms.

The present species is closely allied to *Periclimenes hertwigi* BALSS from Bôsyû (120 m deep) and Kagoshima (120 m), but it is easily distinguished from the latter by having two small outer and inner pairs and one middle larger and longer pair of bristles (instead of 13 bristles) on the distal border of telson.

Periclimenes (*Ancylocaris*) *amamiensis* sp. nov.

(Figs. 11—12)

Rostrum subhorizontal, deep, a little shorter than carapace; dorsal carina extends backwards almost to middle of carapace, bearing seven subequidistant teeth, the hindmost one of which is located on carapace; lower margin convex, armed with two teeth, posterior one of which is inserted under the hindmost tooth but three on upper border (Fig. 11, *B*). Carapace

Fig. 11. *Periclimenes* (*Ancylocaris*) *amamiensis* sp. nov., ♀. *A*, lateral view, ×6; *B*, rostrum, ×ca. 7; *C*, antennule, ×ca. 10; *D*, inner ramus of antennule, ×35; *E*, antennal scale, ×15; *F*, second pereiopod, ×15; *G*, third pereiopod, ×ca. 10; *H*, telson, ×ca. 10; *K*, tip of telson, ×35.

with antennal and hepatic spines, but without supraorbital one (Fig. 11, *A*). Antennular peduncle not extending to tip of rostrum; basal segment flattened, outer margin produced in the form of a promient spine which reaches distal margin of second segment (Fig. 11, *C*); third segment nearly as long as second one, provided with inner thinner and outer thicker flagella; eleventh joint of outer ramus with 9-jointed shorter and many jointed longer branches (Fig. 11, *D*). Antennal scale a little beyond tip of rostrum, outer margin ends in a stout spine extending far beyond distal margin of lamella (Fig. 11, *E*). Mandible without palp, incisor process with three teeth along distal margin (Fig. 12, *A*). Maxillule cross-shaped, inner endite rather narrow, apical lobe of endopodite very small (Fig. 12, *B*). Maxilla carries ear-shaped exopodite, inner distal lacinia bifid at about middle, proximal one absent (Fig. 12, *C*). First maxilliped provided with exopodite bearing rather small basal outer lobe (Fig. 12, *D*). Third maxilliped pediform; antepenult segment about twice as long as wide and 1.5 times as long as penulitmate one which is a little less than twice as long as ultimate one (Fig. 12, *F*). First cheliped slender, proportion against movable finger: palm 1.1, carpus 4.0, merus 3.5, ischium 1.9; cutting edges straight, unarmed (Fig. 12, *F*). Third leg as long as, and somewhat stouter than first one; dactylus simply pointed, a little recurved backwards, about one-fifth of

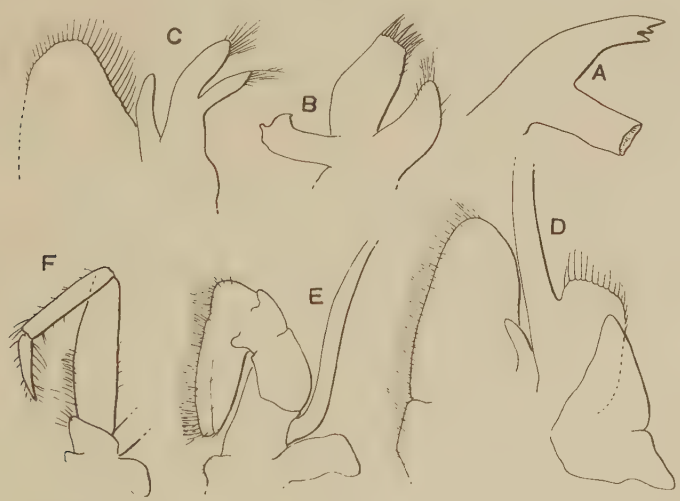

Fig. 12. Mouth-parts of *Periclimenes* (*Ancylocaris*) *amamiensis* sp. nov. *A*, mandible, ×35; *B*, first maxilla, ×35; *C*, second maxilla, ×35; *D*, first maxilliped, ×35; *E*, second maxilliped, ×25; *F*, third maxilliped, ×15.

propodus in length; propodus a little longer than merus, width at its middle about one-sixth of length; carpus somewhat longer than ischium; merus carries no spine or seta on distal lower margin (Fig. 11, *G*). Fourth and fifth pairs of legs entirely the same as third one in size and shape. Telson wedge-shaped in profile; distally gradually decreasing its breadth: proximal width in the widest region about three times as much as distal breadth between postero-lateral angles; each dorso-lateral margin armed with two bristles, one at three-fourths and the other at five-sixths; distal margin convex, fringed with 9 bristles (Fig. 11, *H* and *K*).

The above mentioned description is based on a single mutilated specimen of ovigerous female (second cheliped wanting), 12.0 mm in body length, obtained on August 7th, 1927 from Ôsima, Riu-Kiu Islands.

The present species bears very close resemblance to *P.* (*Ancylocaris*) *seychellensis* (BORRADAILE) (BORRADAILE, 1917, p. 375 and KEMP, 1922, p. 176) but differs from it by many important characters as shown in the following table:—

Items	*P. seychellensis*	*P. amamiensis*
(1) Rostrum	a little beyond distal end of antennal scale.	not reaching to distal end of antennal scale.
(2) Eye stalk	with a small conical papilla on upper border.	without papilla.
(3) Outer antennular flagellum	basal fused part 5—7-segmented, distal shorter ramus comprising 4 segments.	basal fused part 11-jointed, distal shorter ramus composed of 9 segments.
(4) Antennal scale	distal spine reaching to or beyond end of lamella.	distal spine projecting far beyond distal margin of lamella.
(6) Last three pairs of thoracic legs	slender, length of propodus about 13 times as much as width at its middle.	stout, length of propodus about 7 times of breadth at its middle.
(5) First cheliped	merus and carpus subequal in length, palm somewhat shorter than finger.	merus shorter than carpus, palm a little longer than finger.

Periclimenes (*Ancylocaris*) *brevicarpalis* (SCHENKEL)

(Figs. 13—14)

Periclimenes (*Ancylocaris*) *brevicarparis*, KEMP, 1922, pp. 185—191, Pl. 6, fig. 8.

Periclimenes hermitensis RATHBUN, 1914, p. 655, pl. 1, fig. 1—3.

Ancylocaris aberrans, BORRADAILE, 1917, p. 355 and 356.

Mandible Y-shaped, without palp, consists of molar and incisor pro-

cesses, the latter one armed with three teeth on distal margin (Fig. 13, *A*). Maxillule cross-shaped, palp with rudimentary apical lobe (Fig. 13, *B*). Maxilla carries an ear-shaped scaphognatite rounded on posterior margin, and papilla-like endopodite, inner distal endite slender but distally bifid, inner proximal one entirely absent (Fig. 13, *C*). First to third maxillipeds provided with exopodite. First maxilliped bears mastigobranchia or epipodite and unsegmented endopodite, basal outer lobe on exopodite broad (Fig. 13, *D*). Second maxilliped with mastigobranchia but without podobranchia (Fig. 13, *E*). Third one pediform, provided with mastigobranchia and podobranchia, penultimate segment one and half, and antepenultimate one about twice, as long as ultimate joint (Fig. 13, *F*). Endopodite of second abdominal appendage of male carries a stylumblys and equally long appendix musculina near proximal inner margin, appendix masculina being fringed with long setae (Fig. 13, *G*).

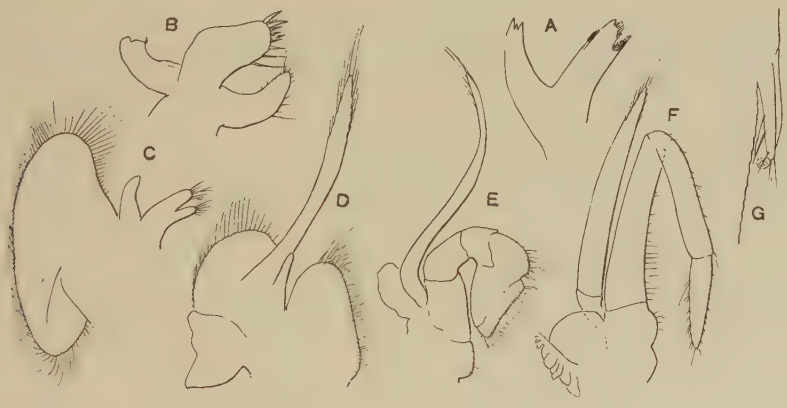

Fig. 13. *Periclimenes* (*Ancylocaris*) *brevicarpalis* (Schenkel), ♂. *A*, mandible, ×28; *B*, maxillule, ×28; *C*, maxilla, ×20; *D*, first maxilliped, ×20; *E*, second maxilliped, ×20; *F*, third maxilliped, ×20; *G*, basal inner border of endopodite of second pleopod with stylamblys and appendix musculina, ×28.

The description mentioned above is based on a male measuring 14.5 mm in body length, and a female 12.0 mm long, obtained in February, 1937 from Isigaki-zima, Riu-Kiu (Okinawa group) by Mr. Sadayoshi Miyake. According to his information, this shrimp was found living in association with giant sea-anemone (*Stoichactis kenti*) measuring about 35 cm in diameter.

Distribution: Zanzibar, Kokotoni, Bawi in E. Africa (Lenz); Djibouti,

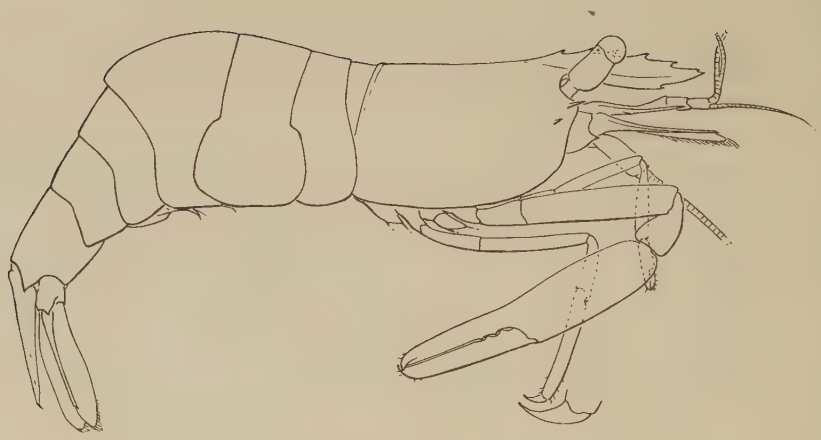

Fig. 14. *Periclimenes* (*Ancylocaris*) *brevicarpalis* (SCHENKEL), ♂, ×ca. 5.

Red Sea; Bahrein Is., Persian Gulf (NOBILI); Hermite Is., N. W. Australia (RATHBUN); Andamaus (KEMP).

Notes: The specimens at my disposal tally completely with KEMP's description of the present species and RATHBUN's one of *Periclimenes hermitensis* (1914).

Genus ***Anchistus*** BORRADAILE

Anchistus, BORRADAILE, 1898, p. 387; 1917, p. 387.

A single species, *A. misakiensis* has hitherto been known from Japan (YOKOYA, 1936, p. 36, fig. 5), but the present author is now in a position to add two more to the Japanese fauna.

Key to the species of *Anchistus*

A. Rostrum without tooth or with rudimentary teeth ..... ***A. miersi.***
B. Apex of rostrum minutely notched ..... ***A. misakiensis.***
C. Rostrum armed with small teeth near apex ..... ***A. inermis.***

Anchistus inermis (MIERS)

(Figs. 15~17)

Harpilius inermis, MIERS, 1884, p. 291, pl. 32, fig. B.
Anchistus inermis, BORRADAILE, 1917, p. 388; TATTERSALL, 1921, p. 391, pl. 27, fig. 4; KEMP, 1922, p. 249, text-fig. 81 (a~d).

Rostrum directed a little downwards, about two-fifths times as long as carapace, apex broadly rounded in profile, distal one-third of upper border

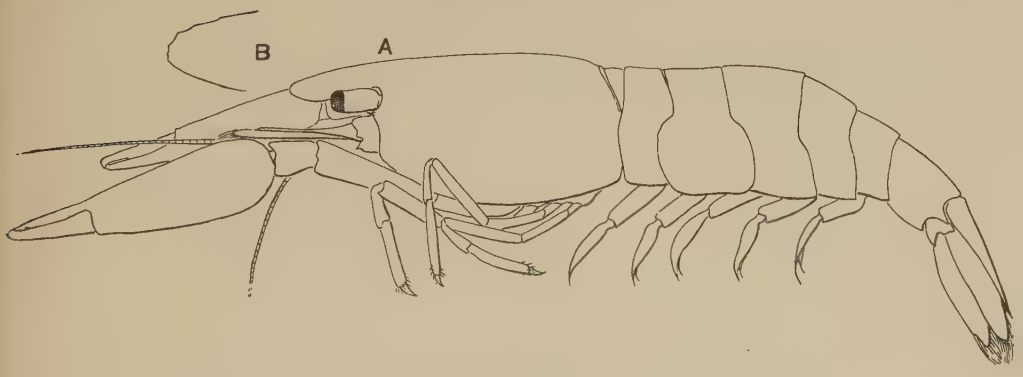

Fig. 15. *Anchistus inermis* (Miers), ♂. *A*, lateral view, ×6; *B*, tip of rostrum, × ca. 22.

with 5 or 6 rudimentary, microscopical teeth (Figs. 15 and 16). Antennular peduncle a little beyond distal end of rostrum; basal segment broad, about twice as broad as penultimate joint of this peduncle, depressed, armed with an acutely pointed process on basal outer margin, distal outer margin ends in a small spine; distal two segments equal in length; ultimate segment carries inner thinner and outer thicker flagella, the thicker one proximally uniramous with 5 or 6 joints and bifid with outer longer and inner shorter branches, the shorter one consists of 5 or 6 segments and fringed with thickly set hairs on outer margin (Fig. 17, *A*). Maxilla provided with lamellar, cuneiform exopodite; endopodite papilla-like, inner distal endite forming a large process (Fig. 17, *C*). Third maxilliped slender, antepenult segment depressed, broad (about twice as broad as penultimate one), slightly longer than distal two segments. Second pereiopod asymmetrical; larger leg somewhat more than twice as long as carapace, ratios of each segment consisting of the leg against movable finger: palm 2, carpus 0.5, merus 1.4, ishium 1.0; fingers with inturned tips and almost straight cutting edges; movable finger armed with two teeth, one at one-fourth and the other at one-third; fixed finger serrated with six teeth on about proximal half of prehensile edge (Fig. 17, *E* and *F*); smaller leg about 1.8 times as long as carapace; proportions to movable finger: palm 1.8, carpus 0.5, merus 1.0 and ishium 0.9; proximal one-fourth and nearly distal half of cutting edge entire but with notches between these straight edges; inmovable one has a notch near proximal two-fifths (Fig. 17, *G* and *H*). Third, fourth and fifth legs alike. Third leg about 1.3 times as long as carapace, propodus about 1.8 times as long as carpus, merus a little longer than propodus,

ischium somewhat longer than carapace, dactylus pointed, remarkably curved backwards (Fig. 17, *K*). Endopodite of second abdominal appendage provided with stylamblys and appendix musculina of almost equal length (Fig. 17, *L*).

Fig. 16. *Anchistus inermis* (MIERS), ♀, 28.5 mm long, × ca. 3, (telson removed)

Female closely resembles male in general aspects but shows such differences as follows:—(1) body larger, (2) second cheliped smaller and shorter, about 1.6 times as long as carapace, (3) teeth on the prehensile edges of second cheliped less prominent than male and (4) endopodite of second pleopod carries a stylamblys only on its proximal inner margin (Fig. 16, *M*).

The above description is based on a male specimen measuring 16.5 mm in body length, and an ovigerous female, 28.5 mm in body length. An immature male specimen, 13.0 mm in body length, was also examined.

Locality: Palau.

Distribution: Porte Molle, Qeensland: Shark Bay, W. Australia (in *Pinna*) (MIERS); Bello Is., N. W. Australia (in *Pinna*) (RATHBUN); Suakin Harbour, Red Sea (in *Pinna*) (TATTERSALL); Arzana Is., Persian Gulf (in *Pinna*): Vanikoro (Sante Cruz group), Polynesia (KEMP).

Note: The branchial arrangement entirely agrees with that of *Anchistus miersi* (DE MAN), to which the present species shows resemblance in having the mouth-parts except maxilla and third maxilliped similarly constructed.

The three specimens under my examination agree well with the descriptions of MIERS and TATTERSALL, but differs from KEMP's description in having two teeth on cutting edge of movable finger of second cheliped.

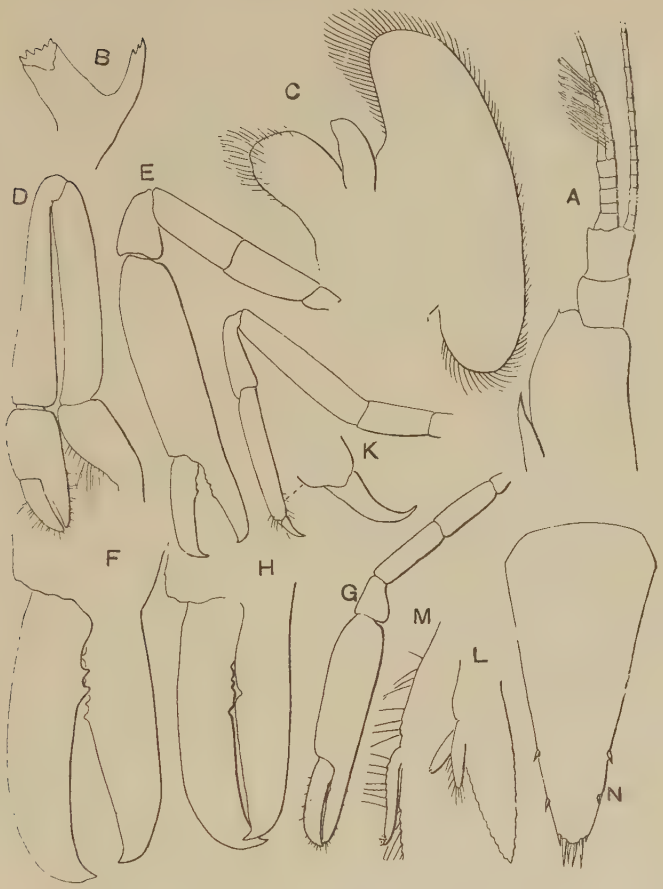

Fig. 17. Body parts of *Anchistus inermis* (Miers), *A*~*D*, *F*~*L* and *N*, male; *E* and *M*, female. *A*, antennule, ×15; *B*, mandible, ×25; *C*, maxillule, ×15; *D*, first pereiopod, ×15; *E*, larger leg of second pair of pereiopod, ♀, ×6; *F*, tip of larger leg of second pereiopods, ♂, ×50; *G*, smaller leg of second pair of pereiopod, ♂, ×6; *H*, same as *G* (tip), ×20; *K*, third pereiopod, ×ca. 10; *L*, endopodite of second pleopod, ×20; *M*, same as *L* (ovigerous female), ×15.

Anchistus miersi (de Man)

(Figs. 18~20)

Anchistus miersi, Borradaile, 1917, p. 388, pl. 56, fig. 25; Tattersall, 1921, p. 391; Kemp, 1922, p. 255, Text-fig. 85.

Harpilus miersi, de Man, 1888, p. 274, pl. 17, fig. 6~10.

Rostrum about 0.4 times as long as carapace, provided with 4~5 sharp teeth on upper border and subterminal one or two teeth on lower one

Fig. 18. *Anchistus miersi* (de Man), ♀, × ca. 6.

(Fig. 18). Antennular peduncle slightly beyond tip of rostrum; basal segment broad, and depressed, outer distal angle ends in a small spine, proximally carries a large outer process, second and third joints equal in length, ultimate segment with inner thinner and outer thicker flagella, outer one proximally uniramous and consisting of 4 or 5 joints but distally bifid with shorter and longer branches, shorter branch 4-segmented and fringed with long hairs (Fig. 20, *A*). Antennal scale somewhat narrowed distally (Fig. 20, *B*). Mandible Y-shaped and without palp, incisor process 4-toothed (Fig. 19, *A*). Maxillule cross-shaped, inner and outer lacinia broad and fringed with thickly set setae on distal margin, exopodite without apical lobe (Fig. 19, *B*). Exopodite of maxilla kidney-shaped, endopodite thumb-like in outline and hairless, inner distal lacinia bifid with two lobes, and anterior one broader than posterior one (Fig. 19, *C*). All three maxillipeds provided with exopodite and mastigobranchia. Endopodite of first maxilliped unsegmented and lobe of exopodite comparatively narrow (Fig. 19, *D*). Third one pediform, ratios of distal three segments to ultimate segment: penultimate one 1.6, antepenult 2.4 (Fig. 19, *F*). Second pereiopod large, about two times as long as carapace; chela heavy, movable finger a little shorter than half of palm, armed with a blunt tooth at one-third of cutting edge; fixed finger serrated with 5 denticles in proximal half (Fig. 20, *C* and *D*). Third leg about 1.3 times as long as carapace; propodus and merus about twice as long as carpus, ishium somewhat longer than carpus; dactylus bifid, outer surface densely ornamented with setae (Fig. 20, *E* and *F*). Fourth and fifth legs similar to third one in general characters. Endopodite of second abdominal appendage carries a longer stylamblys and shorter

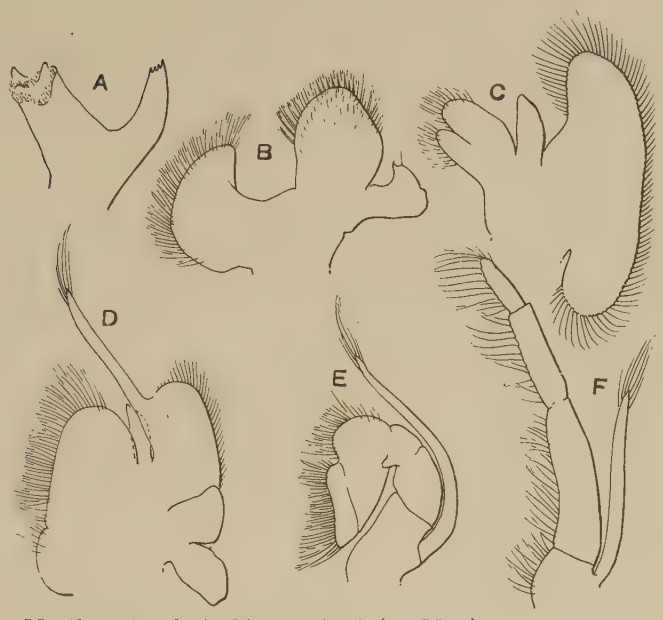

Fig. 19. Mouth-parts of *Anchistus miersi* (DE MAN). *A*, mandible; ×35; *B*, maxillula, ×35; *C*, maxilla, ×25; *D*, first maxilliped, ×25; *E*, second maxilliped, ×25; *F*, third maxilliped, ×20.

appendix masculina on inner proximal margin in male, but the latter absent in female (Fig. 20, *H*).

Fourth to eighth thoracic segments bear one pleurobranchia respectively as shown in the following Table.

	I	II	III	IV	V	VI	VII	VIII
Pleurobranchiae	—	—	—	1	1	1	1	1
Arthrobranchiae	—	—	—	—	—	—	—	—
Podobranchiae	—	—	—	—	—	—	—	—
Mastigobranchiae	2	1	1			—	—	

The above mentioned description is based on 4 male specimens ranging from 10.0 to 18.0 mm and 2 ovigerous female specimens, 13.0 and 17.0 mm in body length.

Locality: Palau (in *Pteria macroptera, Tridacna squamosa* and *Pinctada maxima*) (R. WADA).

Distribution: Elphinstone Is., Mergui Archipelago (DE MAN); Port Blair (in *Tridacna*); Batavia, Reynaud coll.: Pulo Condore, Germain coll. (in *Tridacna*) (KEMP); Mangareva in the Gambier Is. in pearl oyster

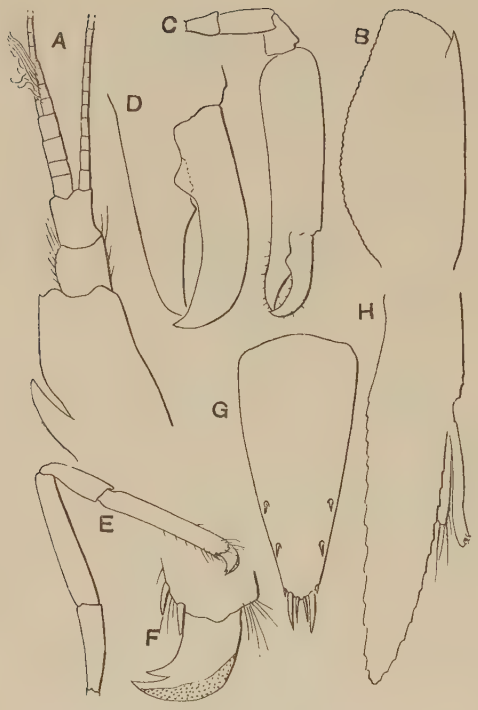

Fig. 20. Body parts of *Anchistus miersi* (DE MAN), ♂. *A*, antennule, ×20; *B*, antennal scale, ×20; *C*, second thoracic leg, ×6; *D*, fingers of the same leg as in *C*, ×ca. 10; *E*, third thoracic leg, ×ca. 10; *F*, dactylus of the same leg as in *E*, ×50; *G*, telson, ×15; *H*, endopodite of second pleopod, ×50.

(NOBILI); Funafuti in the Ellice Is. (WHITELEGGE); D'Entrecasteaux Is., British New Guinea (in *Tridacna squamosa*): Maldives: Seychelles (BORRADAILE); Arzana I., Persian Gulf (in *Spondylus*): Red Sea (in *Pinna*) (NOBILI).

My specimens perfectly agree with DE MAN's original description of *Harpilius miersi* (=*Anchistus miersi*), but differ from KEMP's description of Batavian specimens in having (1) one large tooth instead of two rather small teeth at one-third of cutting edge of movable finger of second cheliped and (2) 4 or 5 denticles (instead of 8 or 9 denticles) in proximal half of the fixed finger.

Genus ***Harpilius*** DANA

Harpilius, DANA, 1852, p. 575; TATTERSALL, 1921, p. 338; KEMP, 1922, p. 226; BORRADAILE, 1917, p. 379.

Of this genus, only one representative, *H. imperialis* KUBO, has been known from Bonin Islands as previously recorded.

Genus *Pontonia* Latreille

Pontonia, Borradaile, 1917, p. 389; Kemp, 1922, p. 259.

Pontonia katoi sp. nov.

(Figs. 21~23)

Body smooth, depressed and swollen. Rostrum depressed, toothless, carinated dorsally and ventrally with very low ridges, slightly curved downwards, bluntly pointed with apical angle about 45°, 0.4 times as long as carapace, reaches to distal tip of outer margin of antennal scale (Fig. 21). Infra-orbital angle produced, but neither antennal nor hepatic spine occur on carapace. Telson, excluding terminal spines, proximal breadth less than twice the breadth measured at antero-lateral angles, armed along each dorso-lateral margin with two bristles dividing it into three intervals with proportions 1:2:1.5; distal margin fringed with two pairs of median and intermediate longer and a pair of outer shorter bristles (Fig. 23, *L*). Eyes well pigmented. Antennular peduncle not reaching to tip of rostrum; basal segment broad and its outer margin ends in a stout tooth reaching distal margin of second segment; second and third segments equal in length and broader than long; third segment provided with inner thinner 9-jointed and outer thicker flagella. Outer one proximally uniramous comprising 4-joints, but distally divided into stouter inner 2-segmented and slenderer outer about 5-segmented branches (Fig. 23, *A* and *B*). Antennal scale oval in outline, outer margin ends in a prominent spine which reaches well beyond the distal margin of lamella and curved inwards (Fig. 23, *C*). Mandible consisting of molar and 5-toothed incisor processes; without palp (Fig. 22, *A*). Maxillule small; inner lacinia narrow, distal margin furnished with setae; outer lacinia curved inwards, its apical margin fringed with stout setae; endopodite bar-shaped, apical lobe absent (Fig. 22, *B*). Maxilla

Fig. 21. *Pontonia katoi* sp. nov., ♂, × 6.

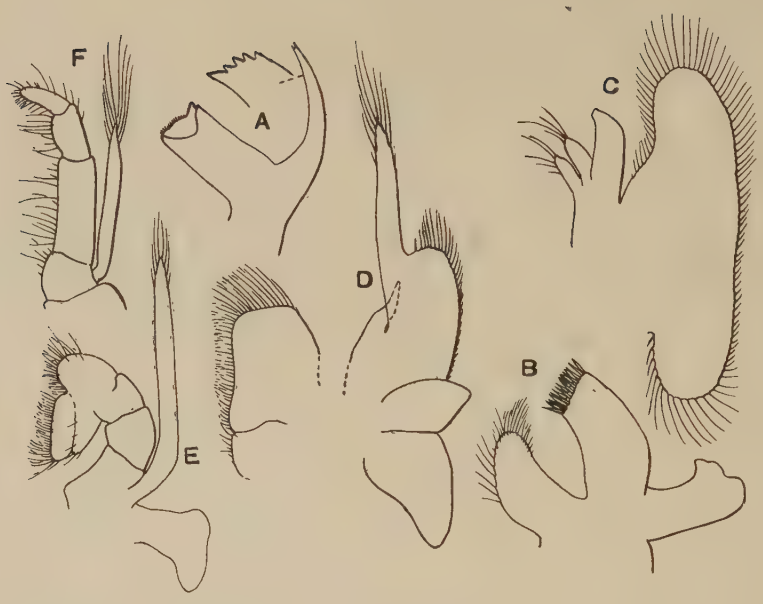

Fig. 22. Mouth-parts of *Pontonia katoi*, sp. nov. *A*, mandible, ×35; *B*, maxillule, ×35; *C*, maxilla, ×35; *D*, first maxilliped, ×25; *E*, second maxilliped, ×25; *F*, third one, ×20.

with large ear-shaped exopodite, thumb-like endopodite and inner distal endite which is bifid with two papilla-like processes (Fig. 22, *C*). First maxilliped carries small endopodite, exopodite and paired mastigobranchiae; inner lacinia broad, furnished with thickly set setae on inner margin (Fig. 22, *D*). Second maxilliped bears exopodite and mastigobranchia (Fig. 22, *E*). Third one five-segmented and provided with exopodite; ultimate and penultimate segments equal in length; antepenult one twice as long as ultimate one (Fig. 22, *F*). First cheliped slender, about 1.3 times as long as carapace; both fingers toothless and leaving no space between them when closed; ratios of each segment to movable finger: palm 1.0, carpus and merus 2.8 (Fig. 23, *E*). Second cheliped massive, asymmetrical, about two times as long as carapace; left one larger than the other, movable finger with inturned tip and a broad tooth at about middle of cutting edge, fixed finger shorter than movable one, armed with two teeth on proximal half of prehensile edge and its tip not recurved inwards, palm about twice as long as wide at middle and about 2.5 times as long as movable finger (Fig. 23, *F*); smaller chela almost similar to larger one in aspect, about 0.7 times as long as larger one, both cutting edges toothless but rugged, movable finger curved inwards,

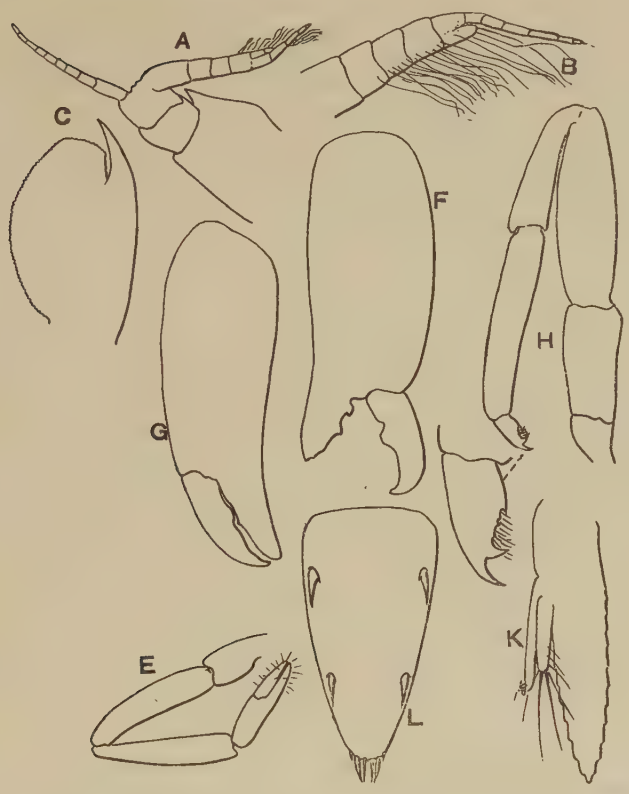

Fig. 23. Body parts of *Pontonia katoi*, sp. nov., ♂. *A*, antennule, ×20; *B*, outer ramus of antennule, ×35, *C*, antennal scale, ×25; *D*, first pereiopod, × ca. 10; *F*, larger chela of second leg, × ca. 7; *G*, smaller one of the same leg as in *F*, × ca. 10; *H*, third leg, ×15; *K*, endopodite of second abdominal appendage, ×35; *L*, telson, ×15.

palm 2 in proportion against finger (Fig. 23, *G*). Third leg somewhat longer than first one, about 1.4 times as long as carapace; dactylus biunguiculate and armed with 4 equidistant small spines in about distal half of posterior margin; propodus 4, carpus 2.5, merus 4, ischium 2 in proportion to dactylus (Fig. 23, *H*). Fourth and fifth legs nearly similar to third one. Endopodite of second pleopod bears longer stylamblys which is a little shorter than endopodite, and shorter appendix masculina distally fringed with long setae (Fig. 23, *K*).

Holotype: Male, 12.0 mm in body length from posterior margin of orbital notch to distal margin of telson.

Paratype: Two males measuring 13.0 mm and 13.5 mm in body length.

Type locality: Off Simoda, Siduoka Prefecture.

Note: The specimens were obtained by Mr. K. KATÔ off Simoda, Siduoka Prefecture. According to his information, a male and female are always found as a pair in branchial chamber of *Cynthia ritteri* OKA.

Judging from the photograph sent by Mr. KATÔ, female closely resembles male in many respects but it is much larger than male. It seems that the left hand of the second cheliped is usually larger in female than in male.

The present species bears much resemblance to *Pontonia anchoreta* KEMP, but it may be distinguished from the latter by the following characters:—(1) penultimate segment of third maxilliped is longer than ultimate one, (2) rostrum reaches well beyond the eye and antennular peduncle, (3) carpus of the first cheliped is much longer than its chela, (4) terminal spine of antennal scale is very large and greatly curved inwards, and (5) dactylus of third leg is provided with a series of distal three small and one large proximal spines behind the two distal claws.

Genus ***Conchodytes*** PETERS

Conchodytes, BORRADAILE, 1917, p. 392; KEMP, 1922, p. 279.

Key to the species of the genus *Conchodytes*

A. Basal protuberance of dactylus of third leg without tooth
  B. Distal outer angle of first segment of antennular peduncle pointed. . ***C. meleagrinae.***
  B′. Distal outer angle of basal segment of first antenna rounded . . . . . ***C. tridacnae.***
A′. Basal process of dactylus of third leg carries a small tooth on proximal margin ***C. nipponensis.***

Conchodytes meleagrinae PETERS

(Figs. 24~25)

Conchodytes meleagrinae, BORRADAILE, 1898, p. 390; 1917, p. 393, pl. 57, fig. 26; KEMP, 1922, p. 285.

Male: Carapace 3.8 times (on average) as long as rostrum. Rostrum depressed, ratio of length against width measured in its basal region about 0.7 (Table 1). First segment of antennular peduncle broad, bears a large lanceolate lateral process, which reaches to about middle of second segment, as well as a spinule at outer distal angle (Fig. 25, *B* and *C*). Mandible without palp; incisor process widely separated from molar one and tipped with five teeth (Fig. 24, *A*). Maxillule provided with inner broad lacinia bearing rather thickly set setae on apical region; outer lacinia fig-shaped,

apical margin armed with many stout setae; endopodite has a small process near inner distal margin (Fig. 24, *B*). Maxilla consists of broad inner endite which is finely fringed with long hairs along inner margin, papilla-like endopodite, and ear-shaped scaphognathite (Fig. 24, *C*). All maxillipeds with exopodite. First maxilliped provided with two mastigobranchiae, unsegmented small endopodite and large lamellar endite on basal lateral margin of exopodite (Fig. 24, *D*). Second maxilliped with mastigobranchia

Fig. 24. Mouth-parts of *Conchodytes meleagrinae* Peters. *A*, mandible, ×20; *B*, maxillule, ×20; *C*, maxilla, ×15; *D*, first maxilliped, ×15; *E*, second maxilliped, ×15; *F*, third maxilliped, ×ca. 10.

(Fig. 24, *E*). Third maxilliped pediform; penultimate and antepenult joints broad; penultimate one more or less shorter than ultimate one and just half times as long as antepenult one (Fig. 24, *F*). First cheliped slender, both prehensile edges toothless, movable finger and palm equal in length, carpus about three times as long as movable finger and somewhat shorter than merus, ischium a little longer than finger (Fig. 25, *E*). Second cheliped very large, asymmetrical; chela heavy and swollen; palm somewhat less than twice as long as movable finger in either hand (Fig. 25, *A* and Table 1).

Table 1.

Measurements of *Conchodytes meleagrinae* (mm)

Male										Female										Locality
No.	*A*	*A/B*	*B*	*C/B*	*C*	*D*	*E*	*D'*	*E'*	No.	*A*	*A/B*	*B*	*C/B*	*C*	*D*	*E*	*D'*	*E'*	
1	7.2	4.2	1.7	0.64	1.1	—	—	—	—	1	11.0	5.5	2.0	0.75	1.5	—	—	7.5	3.6	Palau.
2	6.5	3.2	2.0	0.75	1.5	9.0	5.0	7.5	3.5	2	9.3	5.1	1.8	0.72	1.3	—	—	—	—	
3	7.8	3.9	2.0	0.65	1.3	—	—	—	—	3	8.6	4.0	2.1	0.71	1.5	—	—	—	—	Riu Kiu
4	7.0	3.5	2.0	0.75	1.5	—	—	—	—	4	9.2	4.6	2.0	0.75	1.5	—	—	—	—	
5	6 8	3.5	1.9	0.68	1.3	—	—	—	—	5	9.0	4.7	1.9	0.84	1.6	6.8	3.9	—	—	Isigaki-zima Riu Kiu
6	8.4	5.2	1.6	0.75	1.2	8.4	4.5	6.6	3.8	6	9.5	5.0	1.9	0.68	1.3	—	—	5.6	3.0	
7	7.2	3.7	1.9	0.73	1.4	6.0	3.2	8.4	4.0	7	9.9	4.9	2.0	0.80	1.6	4.8	3.0	—	—	
8	6.7	3.3	2.0	0.65	1.3	—	—	6.6	3.0	8	8.9	6.3	1.4	0.71	1.0	4.0	2.6	—	—	
9	7.5	3.7	2.0	0.75	1.5	7.6	4.9	6.3	3.9	9	9.0	5.0	1.8	0.83	1.5	—	—	—	—	
										10	8.4	4.4	1.9	0.73	1.4	—	—	—	—	
										11	10.7	4.2	2.5	0.76	1.9	5.6	3.2	6.2	3.5	
										12	9.0	4.2	2.1	0.66	1.4	5.5	3.0	5.4	3.2	
										13	9.3	4.4	2.1	0.71	1.5	5.1	3.0	5.0	2.6	
										14	10.1	5.3	1.9	0.78	1.5	5.2	3.1	5.0	3.0	
										15	9.0	4.7	1.9	0.78	1.5	4.0	2.5	4.3	2.4	
										16	7.9	4.0	2.0	0.65	1.3	—	—	4.2	2.5	

A, length of carapace; *B*, length of rostrum; *C*, width of rostrum; *D*, length of palm of right hand of second leg; *E*, length of movable finger of right of second leg; *D'*, length of palm of left hand of second leg; *E'*, length of movable finger of left hand of second leg.

Branchial arrangement runs as follows:—

	I	II	III	IV	V	VI	VII	VIII
Pleurobranchiae	—	—	—	1	1	1	1	1
Arthrobranchiae	—	—	—	—	—	—	—	—
Podobranchiae	—	—	—	—	—	—	—	—
Mastigobranchiae	2	1	1	—	—	—	—	—

Female: Carapace 4.7 times (on average) as long as rostrum (Table 1). Second cheliped large, symmetrical; movable finger more or less longer than the half of palm (Table 1).

Described from 16 ovigerous females measuring 7.9 to 10.7 mm and 9 males ranging from 6.5 to 8.5 mm in carapace length.

Locality: Isigaki-zima, Riu-Kiu, in *Tridacna gigas* (LINNÉ) (Y. OKADA and H. IKEDA); Palau, Caroline Is., in *Pinctada margaritifera* (LINNÉ) (SAITÔ).

Fig. 25. *Conchodytes meleagrinae* PETERS, ♂ and its body parts. *A*, upper aspect of the animal; *B*, inner margin of antennular peduncle (obtained from Riu Kiu), ×20; *C*, antennular peduncle, ×20; *D*, antennule, ×20; *E*, first pereiopod, ×ca. 10; *F*, third pereiopod, ×ca. 10; *G*, telson, ×ca. 10; *H*, tip of telson, ×25.

Distribution: Andamans in *Meleagrina* (KEMP); Solomon, Farquhar, N. W. Cheval (BORRADAILE).

Note: Male differs from female in having (1) rather long rostrum, (2) larger second cheliped and (3) appendix musculina on inner border of endopodite of second abdominal appendage.

The present species is closely allied to *C. tridacnae* PETERS but may be

distinguished from it by the feature of basal segment of antennular peduncle as already pointed out by KEMP (1922). My specimens generally agree well with KEMP's description, but differs from it in having the carpus and merus of first pereiopod equal in length.

Conchodytes tridacnae PETERS

(Figs. 26~27)

Conchodytes tridacnae, BORRADAILE, 1898, p. 390; 1899, p. 1007; 1917, p. 393; KEMP, 1922, p. 283, text-fig. 105.
Pontonia (*Conchodytes*) *tridacnae*, BATE, 1888, p. 707, pl. 124, figs. 1~2.
Pontonia tridacnae, MIERS, 1884, p. 290.
?*Pontonia maculata*, STIMPSON, 1860, p. 38; BALES, 1914, p. 53 (in list).

Carapace about 3.5 times as long as rostrum (Table 1). Rostrum about 1.4 times as long as wide. Distal outer margin of basal segment of antennular peduncle rounded (Fig. 27, *B*). Inner-antennular flagellum consists of 5~9 joints; outer one 4~6 segments in basal uniramous portion, and distally bifid with shorter and longer branches, the former branch comprising 2 or 3 segments, and the latter consisting of 3~5 segments (Fig. 27, *C*). Mouth-parts and branchial arrangement entirely resembles those of *C. meleagrinae*.

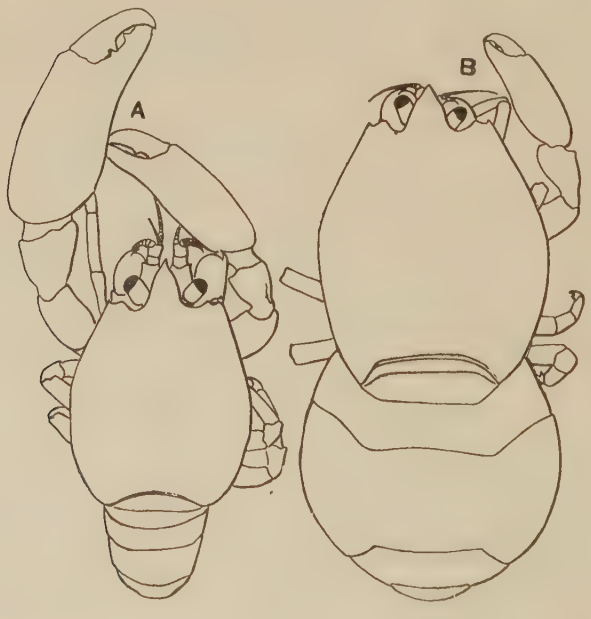

Fig. 26. Upper aspect of *Conchodytes tridacnae* PETERS. *A*, male, ×3.5; *B*, ovigerous female, ×3.

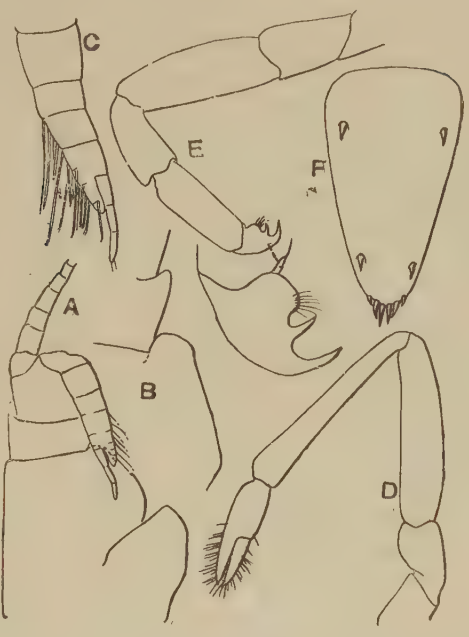

Fig. 27. Body parts of *Conchodytes tridacnae* PETERS, ♀. *A*, antennule, ×20; *B*, outer margin of antennular peduncle; *C*, outer flagellum of antennule, ×35; *D*, first pereiopod, ×ca. 7; *E*, third pereiopod, ×ca. 10; *F*, telson ×15.

Six males measuring from 5.5 to 6.9 mm and 6 ovigerous females 9.3～10.5 mm in carapace length were examined.

Locality: Haha-zima, Bonin Is. (in *Tridacna* sp.) (YAMASITA); Titizima, Bonin Is. (T. SUZUKI); Palau Is. (in *Pictada maxima*) (R. WADA).

Distribution: Warrior Reef, north-eastern coasts of Australia (in pearl-shell) (MIERS); Torres Straits (BATE); Hulule, Malé Atoll, Minikoi (in *Tridacna*) (BORRADAILE); Port Blair (in *Tridacna*) (KEMP).

Note: The specimens obtained from Bonin Islands quite agree with the description of KEMP's *Conchodytes tridacnae*. But the specimens obtained from Palau differ in having much larger second cheliped (Table 2), somewhat longer antennular flagella and a larger number of segments (9～11 segments instead of 5～9 segments as in specimens from Bonin Island) constituting inner antennular flagellum.

Since the size of second cheliped and antennular flagella considerably differ from those of Bonin specimens, I am not quite sure whether Palau specimens should be referred to this species or not.

According to BATE's description and figure of *Pontonia* (*Conchodytes*) *meleagrinae*, the eighth thoracic segment has (1) no pleurobranchia and (2) the basal segment of the antennular peduncle provided with rounded

Table 2.

Measurements of *Conchodytes tridacnae* (mm)

Male										Female										Locality
No.	*A*	*A/B*	*B*	*C/B*	*C*	*D*	*E*	*D'*	*E'*	No.	*A*	*A/B*	*B*	*C/B*	*C*	*D*	*E*	*D'*	*E'*	
1	6.4	3.0	2.1	0.71	1.5	4.3	2.3	5.4	2.8	1	9.3	3.6	2.6	0.73	1.9	4.5	2.1	—	—	Haha-zima, Bonin Islands.
2	5.9	3.5	1.7	0.64	1.1	5.0	2.4	3.8	2.0	2	10.5	3.6	2.9	0.69	2.0	—	—	—	—	
3	5.5	3.7	1.5	0.66	1.0	3.5	1.9	4.5	2.2	3	10.0	3.7	2.7	0.74	2.0	3.9	2.0	—	—	
4	6.5	3.4	1.9	0.73	1.4	3.5	2.0	—	—	4	9.4	3.2	2.9	0.69	2.0	—	—	5.0	2.1	Titi-zima, Bonin Islands.
5	6.5	3.4	1.9	0.73	1.4	4.4	2.5	6.2	3.2	5	9.5	3.7	2.6	0.77	2.0	4.2	2.1	3.6	2.0	
6	6.9	3.1	2.2	0.68	1.5	4.9	2.4	5.4	2.9	6	9.2	3.8	2.4	0.79	1.9	3.0	2.0	—	—	
7	9.9	3.8	2.6	0.73	1.9	11.5	6.0	7.8	3.2	7	9.4	3.4	2.7	0.70	1.9	7.5	3.2	—	—	Palau Islands.
8	10.0	3.4	2.9	0.68	2.0	8.8	3.3	13.2	6.5											
9	9.2	3.0	3.0	0.66	2.0	—	—	—	—											

distal outer margin. Apart from presence or absence of pleurobranchia, the second character puts the material of BATE nearer to *C. tridacnae* than to *C. meleagrinae*.

The present species is intimately allied to *Conchodytes meleagrinae* in general characters, but easily separated from the latter as shown in the already given key.

Conchodytes nipponensis (DE HAAN)

(Figs. 28~29)

Conchodytes nipponensis, PARISI, 1919, p. 75, text-figs. 5 and 6; KEMP, 1922, p. 282, text-fig. 104 (a~d); KUBO, 1937, p. 629, figs. 1~5.
Pontonia nipponensis, DE HAAN, 1850, p. 180, pl. 66, fig. 8; BALSS, 1914, p. 53, fig. 33 BORRADAILE, 1917, p. 391.

Rostrum does not reach to distal margin of second segment of antennular peduncle, about 1.3 times as long as wide (Table 3). Carapace 4.3 times in female, 3.8 times in male, as long as rostrum on average (Table 3). Outer antennular flagellum thicker than inner one, proximally uniramous consisting of 5 or 6 segments, but distally divided into shorter and longer branches; longer one 5~6-jointed whereas the other is provided with 3~4 segments and fringed with long hairs along its outer margin. Endopodite of first pleopod lamellar in both sexes (Fig. 29, *C* and *D*). Endopodite of second abdominal appendage carries longer stylamblys and shorter appendix masculina distally furnished with long hairs in male, while stylamblys only on proximal inner margin in female (Fig. 29, *E* and *F*).

Table 3.

Measurement of *Conchodytes nipponensis* (mm)

Male										Female										Locality
No.	*A*	*A/B*	*B*	*C/B*	*C*	*D*	*E*	*D'*	*E'*	No.	*A*	*A/B*	*B*	*C/B*	*C*	*D*	*E*	*D'*	*E'*	
1	9.2	4.1	2.2	0.81	1.8	—	—	5.5	3.9	1	10.1	4.2	2.4	0.75	1.8	—	—	—	—	Miya, Aiti Pref.
2	0.8	3.4	2.3	0.69	1.6	7.8	4.5	7.5	3.9	2	11.7	4.6	2.5	0.80	2.0	8.2	4.3	8.6	4.6	
3	5.4	2.8	1.9	0.57	1.1	4.9	3.2	4.6	2.9	3	11.1	4.4	2.5	0.80	2.0	7.9	4.7	—	—	
										4	10.5	5.0	2.1	0.95	2.0	8.7	5.0	—	—	
										5	7.0	3.3	2.1	0.66	1.4	5.0	3.2	4.4	2.9	
4	11.7	4.8	2.4	0.83	2.0	—	—	10.4	5.0	6	13.5	4.5	3.0	0.83	2.5	10.6	6	9.2	5.5	Tokyo fish-market.
5	9.7	4.2	2.3	0.86	2.0	8.1	5.0	11.0	5.2	7	14.0	4.6	3.0	0.76	2.3	10.5	5.0	8.2	5.0	
										8	14.3	4.7	3.0	0.86	2.6	—	—	7.4	5.0	
										9	11.0	4.2	2.6	0.73	1.9	6.0	4.0	6.0	3.0	Okino-sima, Tateyama, Tiba Pref.
										10	9.6	3.8	2.5	0.80	2.0	6.0	3.0	5.8	2.8	

Fig. 28. Upper aspect of *Conchodytes nipponensis* (DE HAAN). *A*, female, obtained from Tateyama Bay, Tiba Prefecture, × ca. 2.3; *B*, male, secured from Miya, Aiti Prefecture, × 3.

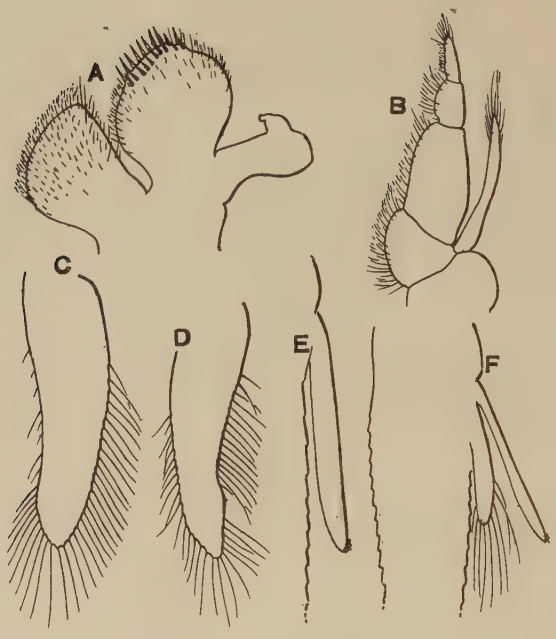

Fig. 29. Body parts of *Conchodytes nipponensis* (DE HAAN). *A*, maxillule, ×20; *B*, third maxilliped, ×6; *C*, endopodite of first pleopod, ♀, ×25; *D*, same as *C*, ♂, ×25; *E*, showing stylumblys of second pleopod of female, ×25; *F*, endopodite of second pleopod of male, ×25.

The above description is based upon 5 male specimens measuring 5.4 to 11.7 mm and 10 females ranging 7.0~14.3 mm in carapace length.

Locality: Off Okino-sima, Tateyama, Tiba Prefecture at a depth of about 7 fathoms, in mantle cavity of *Pecten laquetus* SOWERBY (T. INO); Tokyo fish-market in *Atrina japonica* (REEVE) (K. EBINA); Miya fish-market, Aiti Prefecture in *Atrina japonica* (REEVE) (I. KUBO).

Distribution: Japan (DE HAAN); Hukuura, Sagami Bay (BALSS, PARISI).

Note: Branchial arrangement and mouth-parts excepting maxillule and third maxilliped entirely resemble those of *Conchodytes meleagrinae*. The inner lacinia of maxillule is somewhat smaller than the outer lacima in the present species instead of the inner endite being slightly larger than the outer one as in *C. meleagrinae* (Fig. 29, A). The antepenult segment of the third maxilliped of the present species is broader than that of *C. meleagrinae* (Fig. 29, *B*).

So far as I am aware the host of the present species has never been

known, but it was found by me to be commensal with *Aterina japonica* and *Pecten laquetus*. Usually two which are as a rule a male and a female but sometimes several individuales are found in the mantle cavity of the bivalve.

The present specimens are quite in accord with the descriptions and figures of Balss (1914), Parisi (1919) and Kemp (1922), but differ from de Haan's figure in having greatly shorter antennular and antennal flagella. But it seems to me that de Haan's figure was probably drawn erroneously.

Genus ***Coralliocaris*** Stimpson, emend.

Coralliocaris, Stimpson, 1860, p. 38; Borradaile, 1917, p. 381; Kemp, 1922, p. 268; Rathbun, 1902, p. 122.
Oedipus, Dana, 1852, p. 572. (Preoccupied).

Rostrum compressed, commonly bears teeth on both upper and lower borders. Carapace always provided with antennal spine, but hepatic spine present or absent. Mandible without palp. Maxillule with narrow inner lacinia. Maxilla provided with ear-shaped exopodite, inner distal endite slender. All maxillipeds carry exopodite. Basal outer lobe on exopodite of first maxilliped small. Dactylus of the last three pairs of pereiopod tipped with a single claw bearing basal protuberance.

This genus closely resembles *Harpilius* Dana, but it is easilly separated from the latter by having the following characters:—(1) body more strongly depressed; (2) second cheliped with very heavy, swollen palm; (3) dactylus of last three walking legs provided with remarkably developed basal protuberance.

Key to the species of *Coralliocaris*

A. Inner lacinia of maxilla slender, not bifid at apex; movable finger of second cheliped bar-shaped ..... ***C. superba.***
B. Inner lacinia of maxilla bifid at apex; movale finger of second cheliped semicircular in outline ..... ***C. graminea,***

Coralliocaris superba (Dana)

(Figs. 30~32)

Coralliocaris superba, Borradaile, 1917, p. 383; Balss, 1914, p. 53 (in list); Tattelsal, 1921, p. 390; Kemp, 1922, p. 272, text-figs. 98 and 99; Ortmann, 1890, p. 509, taf. 36, fig. 22.
Oedipus superbus, Dana, 1852, p. 575, pl. 37, figs. 2 (a~f).

Rostrum horizontal, acutely pointed, bears from 3 to 6 equidistant

teeth above (hindmost tooth never placed on carapace), 2 teeth on subterminal lower border; proportions against length of carapace: length 0.8, breadth 0.2 (Fig. 32, *A*). Carapace with antennal spine, but without hepatic one; antero-lateral angle rounded. Telson oblong, armed along each dorso-lateral margin with two bristles dividing its length into three intervals with ratios: proximal 2.5: intermediate 1: distal 2, the widest region near proximal margin about three times as broad as distance between postero-lateral angles, distal margin convex with a pair of outer shorter and two pairs of subequal, equidistant, inner bristles (Fig. 32, *H*). Eye large, well-pigmented. Mandible Y-shaped, without palp; incisor process compressed, serrated with a pair of outer larger and three smaller, subequal, inner teeth along distal border; molar process fringed with rather longer hairs at its apex (Fig. 31, *A*). Inner lacinia of maxillule narrow, endopodite with a small apical process (Fig. 31, *B*). Maxilla with a slender inner distal endite bearing several setae at apex, papilla-like endopodite and ear-shaped exopodite (Fig. 31, *C*). Each maxilliped provided with exopodite and mastigobranchia (Fig. 31, *D*~*F*). Third maxilliped stout, shorter than its exopodite; ultimate joint bears a protuberance on inner subbasal border; penultimate segment somewhat shorter than ultimate one; antepenult joint a little less than twice as long as ultimate one, width about one-third of its length (Fig. 31, *F*). First pereiopod very slender, ratios against movable finger: palm 1.5, carpus and merus 5, ischium ca. 1,

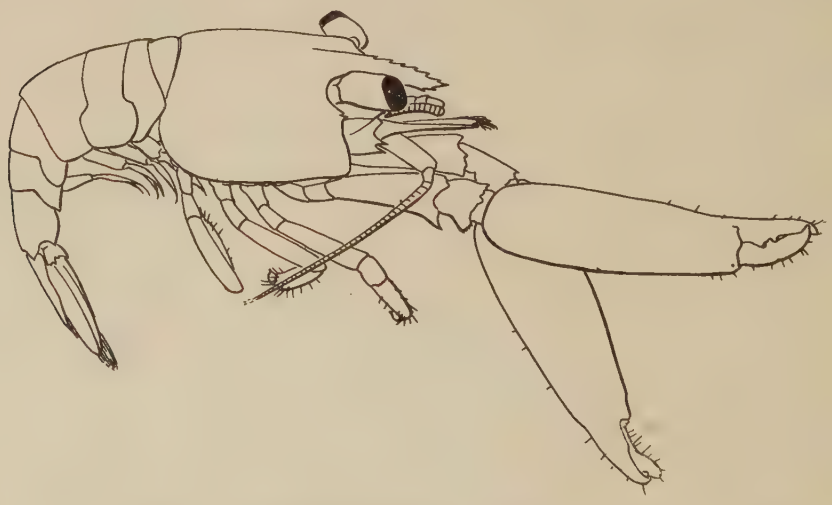

Fig. 30. *Coralliocaris superba* (DANA), ♂, ×ca. 6.

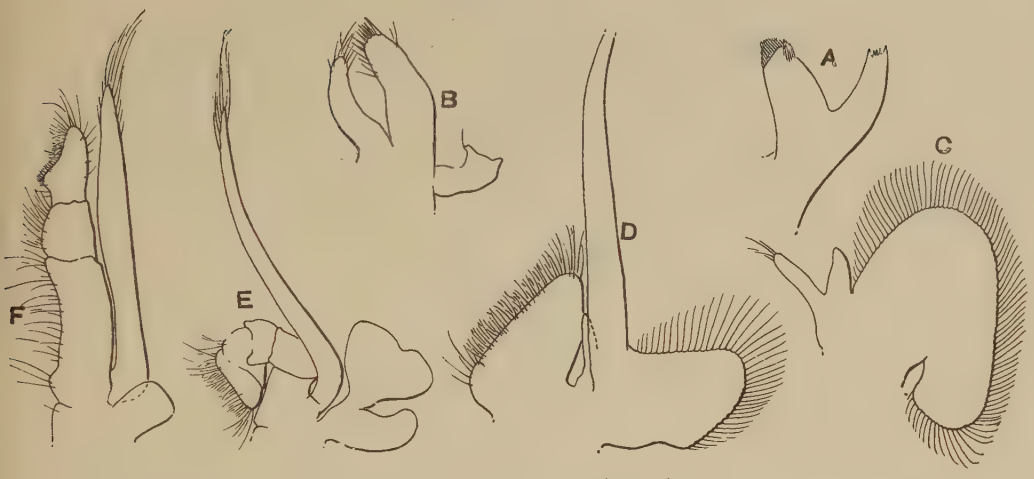

Fig. 31. Mouth-parts of *Coralliocaris superba* (Dana). *A*, mandible, ×35; *B*, maxillula, ×50; *C*, maxilla, ×25; *D*, first maxilliped, ×35; *E*, second maxilliped, ×20; *F*, third maxilliped, ×20.

both cutting edges of chela straight and without tooth (Fig. 32, *C*). Endopodite of second pleopod leaf-shaped, provided with two appendices of unequal lengths on inner proximal border in male (Fig. 32, *F*), but in female with an appendix interna only (Fig. 32, *G*).

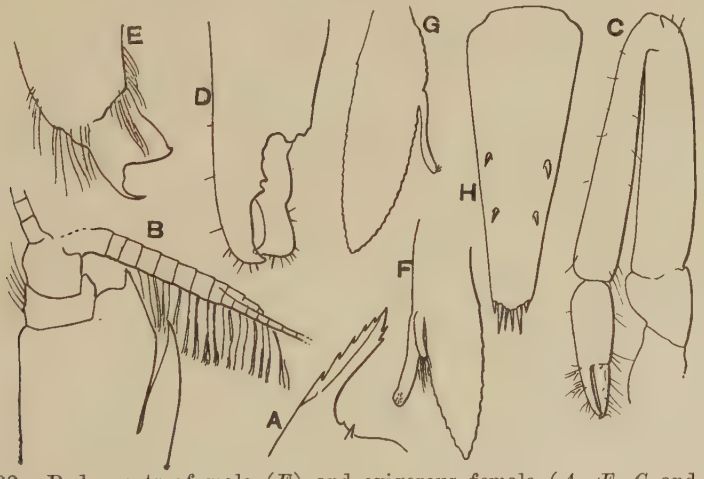

Fig. 32. Body parts of male (*F*) and ovigerous female (*A*~*E*, *G* and *H*) of *Coralliocaris superba* (Dana). *A*, rostrum, ×25; *B*, first antenna, ×20; *C*, first thoracic leg, ×20; *D*, tip of second thoracic leg, ×ca. 10; *E*, dactylus of third pereiopod (outer view), ×35; *F*, second pleopod, ×35; *G*, second pleopod of female, ×25; *H*, telson, ×20.

The description mentioned above is based on two males ranging from 11.0 mm to 11.5 mm and a female specimen 13.0 mm in body length.

Locality: Nankin-Hama, Haha-zima, Bonin Is. (31th July of 1927).

Distribution: Tongatabu (DANA); Tahiti (STIMPSON); Bonin Is. (BALSS); Noordwacher Is. and Bay of Batavia (DE MAN); South coast of Arabia (BALSS); Red Sea (NOBILI, BALSS and TATTERSALL); Port Blair, Andamans (KEMP).

Coralliocaris graminea (DANA)

(Figs. 33~35)

Oedipus granineus, DANA, 1852, p. 573, Pl. 37, figs. 3 a~e.
Coralliocaris graminea, CALMAN, 1907, p. 706; BORRADAILE, 1917, pp. 324, 383; KEMP, 1922, p. 269, Text-figs. 96 and 97.

Rostrum rather shallow, about 0.8 times as long as carapace. Sixth abdominal somite not elongated, hardly 0.4 times as long as telson (Fig. 33 and 35, *A*). Telson in its proximal widest region about 3.5 times as broad as distal margin; each dorso-lateral border with two bristles which are so arranged as to divide its about distal half into two subequal intervals; terminal margin fringed with three pairs of equidistant bristles, the outermost of which is placed close to postero-lateral angle (Fig. 35, *K*). Antennular peduncle does not reach to tip of rostrum; basal joint depressed, broad, with large lanciform lateral process, outer margin ends in a spiniform process; second and third segments subequal in length; ultimate segment provided with inner thinner and outer thicker flagella, the latter proximally uniramous bearing five joints, distally giving off two longer and shorter (about 5~6 segmented) rami (Fig. 35, *B* & *C*). Mandible without palp, incisor process with 7 teeth on cutting edge (Fig. 34, *A*). Maxillule with slender, recurved inner lacinia, outer lacinia furnished with rather thickly set setae on distal margin; apical lobe of endopodite rudimentary (Fig. 34, *B*). Maxilla with thumb-like endopodite, and slender inner distal endite bifid in its distal one-fifth (Fig. 34, *C*). All maxillipeds carry whip-like exopodite. First maxilliped bears rather small lobe on basal outer margin of exopodite (Fig. 34, *D*). Third maxilliped stout, pediform; ratios against ultimate segment: penultimate 0.9, antepenult 1.2; penultimate joint fringed with thickly set setae on inner border (Fig. 34, *F*). First thoracic leg feeble; palm about one and half times, carpus five times, as long as movable finger; merus somewhat shorter than carpus; chela furnished with many transversally arranged stout setae in proximal half of inner border (Fig. 35,

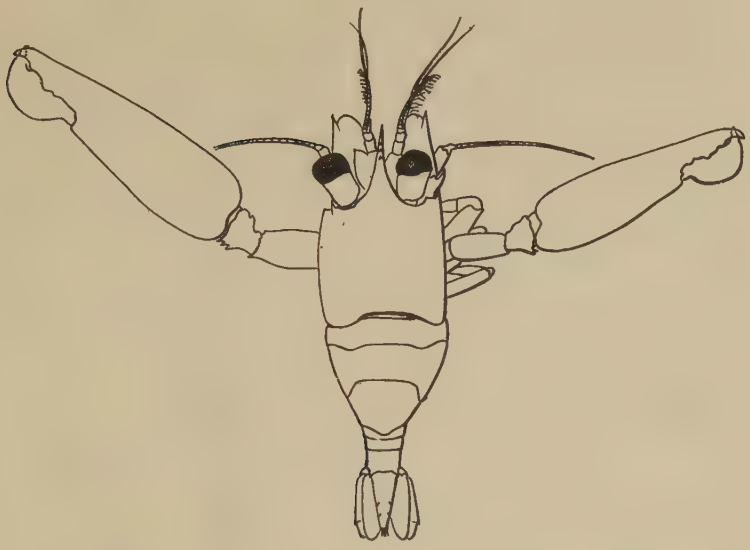

Fig. 33. *Coralliocaris graminea* (DANA), ♀, ×ca. 3.

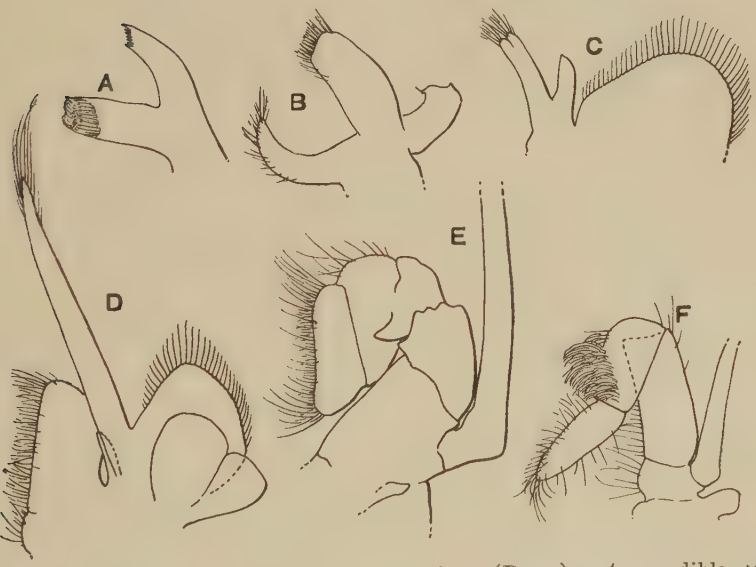

Fig. 34. Mouth-parts of *Coralliocaris graminea* (DANA). *A*, mandible, ×35; *B*, maxillule, ×35; *C*, maxilla, ×25; *D*, first maxilliped, ×25; *E*, second maxilliped, ×35; *F*, third maxilliped, ×20.

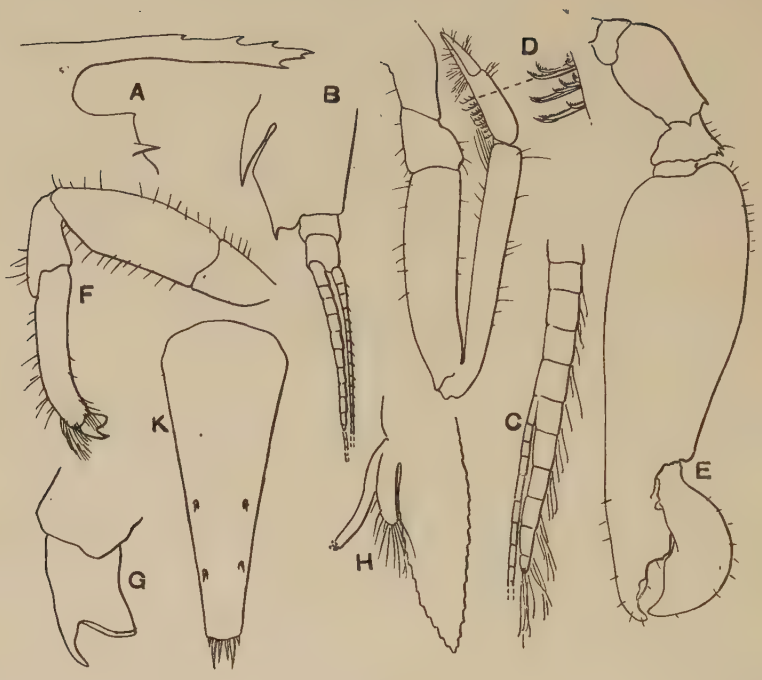

Fig. 35. Body parts of male (*H*) and female (*A*~*G* and *K*) of *Coralliocaris graminea* (DANA). *A*, rostrum, ×35; *B*, antennule, ×ca. 10; *C*, outer flagellum of antennule, ×25; *D*, first pereiopod, ×15; *E*, second pereiopod (outer view), ×6; *F*, third pereiopod, ×ca. 10; *G*, dactylus of third pereiopod, ×35; *H*, second pleopod, ×35; *K*, telson, ×20.

D). Second cheliped unequal in size palm about two times as long as movable finger. Endopodite of second pleopod of male carries longer stylamblys and shorter appendix masculina on inner basal border (Fig. 35, *H*), but stylamblys only in female.

Three ovigerous female specimens ranging from 13.0 to 13.6 mm and one male specimen measuring 12.0 mm in body length were used for the above mentioned description.

Locality: Ôsima, Riu-Kiu.

Distribution: Fiji Is. (DANA); Samoa (ORTMANN); Loyalty Is.; Coetivy (BORRADAILE); Hong Kong (STIMPSON); Ternate; Pulo Edam, Bay of Batavia (DE MAN); Christmas Is. (CALMAN); Seychelles (MIERS); Andamans (KEMP).

Note: My specimens argree closely with the description of KEMP, but differ from that of DANA in the proportion of the chela of the second thoracic

leg, viz., "the finger hardly one-fourth the hand in length." Again the present specimens agree almost completely with ORTMANN's *Coralliocaris inaequalis*, the only point of difference being the proportionate length of the palm and fingers of the second peraeopod. In ORTMANN's work, the said leg is simply described as follows:—"Finger viel kürzer als die Palma, der beweglicher mit stark convexem, ganzrandigen Aussenrande." His figure of the species in question shows, however, that the palm of the second leg is about five times as long as the movable finger.

Whatever either his text or figure is correct such variations in length of joints do not warrant one to recognize the specimens distinct from a species with which they are otherwise in complete agreement.

Remarks on Mouth-Parts

Though many valuable works have been done on the shrimps belonging to Pontoniinae, little is known of their mouth-parts. Three types have been found by the present author in the inner distal endite of maxilla, viz., (I) single lobed group (Fig. 36, *A*~*H*); (II) distally bifid group (Fig. 36, *I*~*R*) and (III) two lobed group (Fig. 39, *S*~*Z*) as shown in the figure 36. Type I is observable in such species, as *Periclimenes* (*Ancylocaris*) *lucanii*[10], *Periclimenes* (*Periclimenaeus*) *robustus*[8], *Coralliocaris superba*, *Harpilius imperialis*, *Anchistus inermis*, *Conchodytes nipponensis*, *Conchodytes meleagrinae*, and *Conchodytes tridacnae*. Type II is typified by the following

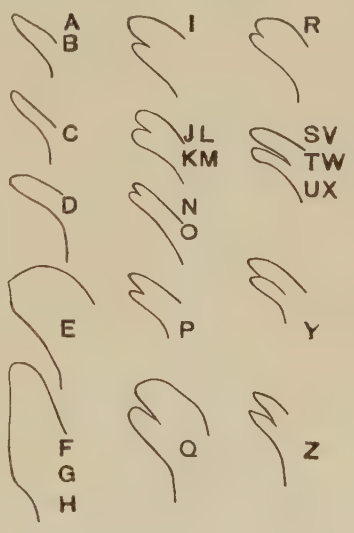

Fig. 36. Inner distal endite of maxilla. *A, Periclimenes* (*Ancylocaris*) *lucasii*[10]; *B, Periclimenes* (*Periclimenaeus*) *robustus*[8]; *C, Coralliocaris superba; D, Harpilius imperialis; E, Anchistus inermis; E, Conchodytes nipponensis; G, Conchodytes meleagrinae; H. Conchodytes tridacnae; I, Periclimenes* (*Periclimenaeus*) *gorgonidarum; J, Periclimenes seychellensis*[8]; *K, Periclimenes spiniferus*[8]; *L, Periclimenes brocki*[8]; *M, Periclimenes maxillulidens*[30]; *N, Coralliocaris pearsei*[27]; *O, Coralliocaris graminea; P, Harpilopsis depressus*[8]; *Q, Anchistus miersi; R, Urocaris psamathe*[8]; *S, Periclimenes* (*Periclimenes*) *curvirostris; I, Periclimenes* (*Periclimenes*) *alcocki; U, Periclimenes* (*Ancylocaris*) *gracilirostris; V, Periclimenes* (*Ancylocaris*) *amamiensis; W, Periclimenes* (*Ancylocaris*) *akiensis*[16]; *X, Periclimenes portoricensis*[28]; *Y, Urocaridella gracilis*[8]; *Z, Pontonia katoi.*

species, *Perichimenes* (*Periclimenaeus*) *gorgonidarum*, *Periclimenes seychellensis*[8], *Periclimenes spiniferus*[8], *Periclimenes brocki*[8], *Periclimenes maxillulidens*[30], *Coralliocaris pearsei*[27], *Coralliocaris graminea*, *Harpilopsis depressus*[8], *Anchistus miersi* and *Urocaris psamathe*[8]. On the other hand, *Perichimenes* (*Periclimenes*) *cruvirostris*, *Periclimenes* (*Periclimenes*) *alcocki*, *Periclimenes* (*Ancylocaris*) *gracilirostris*, *Periclimenes* (*Ancylocaris*) *amamiensis*, *Periclimenes* (*Ancylocaris*) *akiensis*[16], *Periclimenes portoricensis*[28], *Urocaridella gracilis*[8] and *Pontonia Katoi* are characterized by having type III.

Whether it has any phylogenetic meaning or not, the author is not in a position to answer now. But the fact seems to be worthy of record.

Literature

(1) ALCOCK, A., 1901: Cat. Ind. deep-sea Crust. Decap. Macrura and Anomala.

(2) BALSS, H., 1913: Diagnosen neuer Ostasiatischer Macruren. Zoolg. Anz., **32**.

(3) ——, 1914: Ostasiatische Decapoden, II. Abhandl. math.-phys. Klasse K. Bayer. Akad. Wiss. Suppl.-Bd. II, Abhandlg. 10.

(4) ——, 1924: Ostasiatische Decapoden, V. Die Oxyrhynchen und Schlussteil. Archiv für Naturg. Abteil. A, Heft 5.

(5) BATE, S., 1888: Challenger Report, **24** (Macrura).

(6) BOONE, L., 1930: Scientific results of the cruises of the yachts "Eagle" and "Ara", 1921~1928, W. K. Vanderbilt, commanding. Bull. Vanderbilt Marine Mus., **3**.

(7) BORRADAILE, L. A., 1898: On some crustaceans from the South Pacific, III. Macrura. Proc. Zool. Soc. London.

(8) ——, 1919: The Percy Sladen Trust Expedition to the Indian Ocean in 1905, VIII. On the Pontoniinae. Trans. Linn. Soc. London, **17**.

(9) CALMAN, W. T., 1900: On decapod Crustacea from Christmas Island, collected by Dr. C. W. ANDREWS. Proc. Zool. Soc. London.

(10) CHACE, F. A., 1937: The Templeton Crocker Expedition, 7. Caridean Decopod crustacea from the gulf of California and the west coast of lower California. Zoologica, **22**.

(11) DANA, J. D., 1852: United States Exploring Expedition, **13**. Crust, I.

(12) DE HAAN, W., 1850: Fauna Japonica (Crustacea).

(13) HALE, H. M., 1921: The crustaceans of South Australia, Part I. Adelaide.

(14) KEMP, S., 1922: Notes on Crustacea Decapoda in the Indian Museum, XV. Pontoniinae. Rec. Ind. Mus. **24**.

(15) ——, 1925: Notes on Crustacea Decapoda in the Indian Museum, XVII. On various Caridea. Rec. Ind. Mus., **27**.

(16) KUBO, I., 1936: Two new littoral macrurous crustaceans from Japan. Jour. Imp. Fish. Inst., **31** (2).

(17) ——, 1937: On the commensal shrimps of the genus *Conchodytes* in the mantle-cavity of bivalves. Botany and Zoology, **5** (3) (in Japanese).

(18) LEBOUR, M. V., 1938: Decapod Crustacea associated with the Ascidian *Herdmania*. Proc. Zool. Soc. London, Ser. B.

(19) Miers, E. J., 1884: Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. Alert, 1881~2.
(20) Ortmann, A., 1891: Die Decapoden Krebse des Strassburger Museums, I. Zoolog. Jahrb. (Abteil. für Syst.), **5**.
(21) Parisi, Bruno, 1919: I Decapodi giaponensi del Musso di Milano, VII. Natantia. Atti Soc. Ital. Sci. Nat., **58** (1).
(22) Pesta, O., 1911: Beitrag zur Kenntnis der Pontoniiden. *Marygrande mirabilis* nov. gen. nov. spec. Zool. Ang., **38**.
(23) ——, 1918: Die Decapodenfauna der Adria. Wien.
(24) Rathbun, M. J., 1902: The Brachyura and Macrura of Porto Rico. Bull. U. S. Fish Comm., **20** (for 1900).
(25) ——, 1906: The Brachyura of the Hawaiian Islands. Bull. U. S. Fish Comm., **23** (for 1903).
(26) ——, 1914: Stalk-eyed crustaceans collected at the Monte Bello Islands. Proc. Zool. Soc. London.
(27) Schmidt, W. L., 1932: Inhabitants of certain sponges at Dry Tortugas. Carnegie Inst. Washington Pub., 435.
(28) ——, 1933: Four new species of decopod crustaceans from Porto Rico. American Mus. Novitates, No. 662.
(29) ——, 1921: The marine decapod Crustacea of California. Univ. Califor. Pub. Zool., **23**.
(30) ——, 1936: Macruran and Anomuran Crustacea from Bonaire, Curacao and Aruba. Zool. Jahrb., **67**.
(31) Stimpson, W., 1860: Prodromus descriptionis animalium evertebratorum expeditionis ad Oceanum Pacificum septemtrionalem, Pars VIII. Crustacea Macrura. Proc. Acad. Nat. Sci., Philadelphia.
(32) Tattersall, Walter M., 1921: Report on the Stomatopoda and macrurous Decapoda collected by Mr. Cyril Crossland in the Sudanese Red Sea. Jour. Linn. Soc. London, **34**.
(33) Yokoya, Y., 1936: Some rare and new species of decapod Crustacea found in the vicinity of Misaki Marine Biological Station. Japanese Jour. Zool., **7** (1).

On Some Littoral Shrimps Collected from Micronesia[1]

Ituo Kubo

(Received April 16, 1940)

Some littoral shrimps obtained from Kusaie and Palau Islands were placed at my disposal through the courtesy of Dr. Teiso Esaki of the Kyûshû Imperial University. They are referable to seven species belonging to four families and six genera. Of these, two, namely, *Athanas esakii* and *Synalpheus kusaiensis*, proved to be new to science and it is with honour that the former is dedicated to Dr. Esaki. Two other species, viz., *Stenopus hispidus* Olivier and *Gnathophyllum americanum* Guérin, are the cosmopolitan and all the others are Indo-Pacific forms.

In this study, the present author has endeavoured to make accurate observation on mouth-parts and pleopods in order to supplement the papers already published on these shrimps by many authors.

Body length, unless otherwise noted, is measured from orbital notch to distal margin of telson.

I wish to express my hearty thanks to Professor Arata Terao for his kind supervision during the course of this study, and also to Dr. Teiso Esaki for his favour of the valuable specimens.

Family HIPPOLYTIDAE Bate (1888)

Bate, 1888, p. 576; Ortmann, 1891, p. 493; Rathbun, 1902, p. 113; Schimitt, 1921, p. 47.

Lysmata chiltoni Kemp

(Text-figs. 1~4)

Lysmata chiltoni, Kemp, 1914, pp. 110~112, Pl. 6, figs. 1~4.

Mandible without both incisor process and palp, molar process furnished with a band of setae near its distal margin (Fig. 1, *A*). Maxillule

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(1) Contribution from the Zoological Laboratory, Imperial Fisheries Institute, No. 103.

Results of Professor T. Esaki's Micronesia Expeditions, 1936–'38, No. 36.

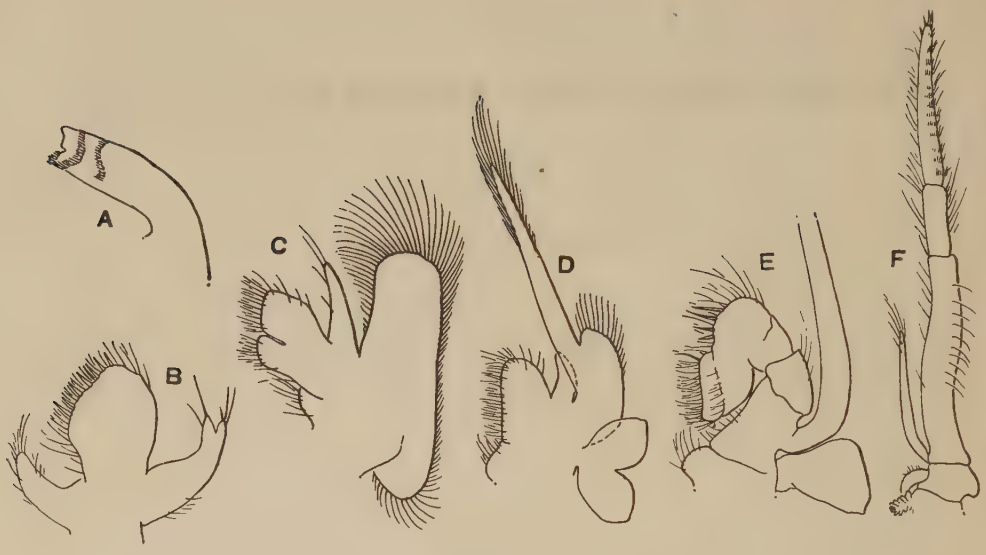


Fig. 1. Mouth-parts of *Lysmata chiltoni* KEMP. *A*, mandible, ×35; *B*, first maxilla, ×35; *C*, second maxilla, ×25; *D*, first maxilliped, ×20; *E*, second maxilliped, ×25; *F*, third maxilliped, ×ca. 10.

cross-shaped, inner endite slender, endopodite provided with apical lobe (Fig. 1, *B*). Maxilla with ear-shaped exopodite; endopodite papilla-like and unsegmented; inner distal lacinia broad, divided distally into two distal broader and proximal narrower lobes; inner proximal lacinia rudimentary (Fig. 1, *C*). All three maxillipeds provided with exopodite. First maxilliped carries rather narrow lobe on basal outer margin of exopodite, endopodite thumb-like. Third maxilliped pediform, penultimate segment a little shorter than half of last segment, and antepenult one still shorter (Fig. 1, *D*~*F*). First cheliped about half times as long as body, ratios against movable finger: palm 1.5, carpus and merus 2, ischium 1; both fingers with almost straight cutting edges and inturned tips (Fig. 3, *A*). Second leg very slender, more or less shorter than body, palm and movable finger subequal in length, proportions to chela: carpus 7.0, merus and ischium about 3.5; both fingers unarmed, movable finger decidedly longer than fixed one; ischium, merus and carpus annulated such as 4, 14, 23 respectively (Fig. 3, *B*). Third one somewhat stouter and shorter than second one, ratios against dactylus: propodus 3.5, carpus 2.5, merus 5.0, ischium 1.2; dactylus armed with three bristles along posterior margin, propodus provided with six equidistant bristles along posterior margin

Fig. 2. *Lysmata chiltoni* KEMP, ♂, × 6.

(Fig. 3, *C*). Fourth and fifth legs closely resemble third one in general aspect, but somewhat shorter. Endopodite of first abdominal appendage tapering in both sexes, but without tuft of microscopic curled hairs on its distal border in female (Fig. 4, *A* and *F*). Endopodite of second pleopod provided with a shorter stylamblys and a longer appendix musculina in male (Fig. 4, *B*), but stylamblys only in female (Fig. 4, *G*).

Branchial arrangement of posterior five segments of thorax is as follows:—

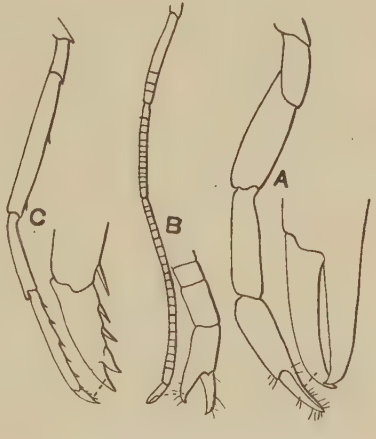


Fig. 3. Body parts of *Lysmata chiltoni* KEMP. *A*, first thoracic leg, × ca. 10; *B*, second thoracic leg, × 6; *C*, third thoracic leg, × 6.

	IV	V	VI	VII	VIII
Pleurobranchiae	1	1	1	1	1
Arthrobranchiae	—	—	—	—	—
Podobranchiae	—	—	—	—	—
Mastigobranchiae	1	1	1	1	—

The above mentioned description and figures are based on a male specimen measuring 12.0 mm in body length. One ovigerous female, 18.0 mm long and three males ranging 6.0~9.0 mm in body length were also examined.

Locality: Kusaie, Caroline Islands.

Distribution: Meyer Island (Kermadec).

Note: The appendix masculina of endopodite of second pleopod appears even in such a small specimen measuring 6.0 mm in body length, although it is still shorter than the stylamblys (Fig. 4, *E*), thus enabling one to easily distinguish both sexes of this shrimp.

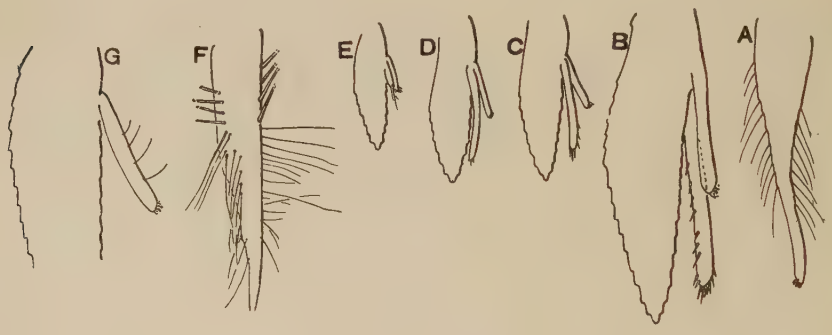


Fig. 4. First (*A* and *F*) and second (*B*~*E* and *G*) pleopods of male (*A*~*E*) and female (*F* and *G*) of different body length. All figures are magnified 35 times. *A*, *B*, 16 mm long; *C*, 9 mm; *D*, 8 mm; *E*, 6 mm; *F*, and *G*, 12 mm.

As described above, the specimens at my disposal are discrepant from KEMP's description of this species in some points, especially in the number of articulation of merus and carpus of second leg, but such differences are nothing but individual variations.

Saron marmoratus (OLIVIER)

(Text-figs. 5~6)

Hippolyte marbré—*H. marmoratus*, MILNE-EDWARDS, 1837, p. 379, pl. 25, fig. 8.

Hippolyte gibbosus, DANA, 1852, p. 565, pl. 36, fig. 4.

Saron marmoratus, Borradaile, 1898, p. 1009; Kemp, 1914, p. 84.
Saron gibberosus, de Man, 1903, p. 852, pl. 1, fig. 1; Coutière, 1910, p. 71.

Body moderate, shell smooth. Rostrum large, laterally compressed and remarkably curved upwards in distal half, about 1.2 times as long as carapace, dorsal carina extending backwards to anterior two-thirds of carapace, six teeth on upper border: three outside and three inside frontal margin of carapace, lower border provided with seven teeth (Fig. 5, *A*). Suborbital spine well developed, branchiostegal one present but small, pterygostomian angle spiniform. Sixth abdominal segment with movable spinule on each side near base of uropod (Fig. 5, *B*). Telson subrectangular but gradually decreasing its width posteriorly, each dorso-alteral margin armed with two bristles dividing it into three intervals with ratios, 1.4:1:1.4, distal margin ends in a minute spiniform process at middle, armed with two pairs of outer shorter and inner longer bristles (Fig. 5, *B*). Antennular peduncle

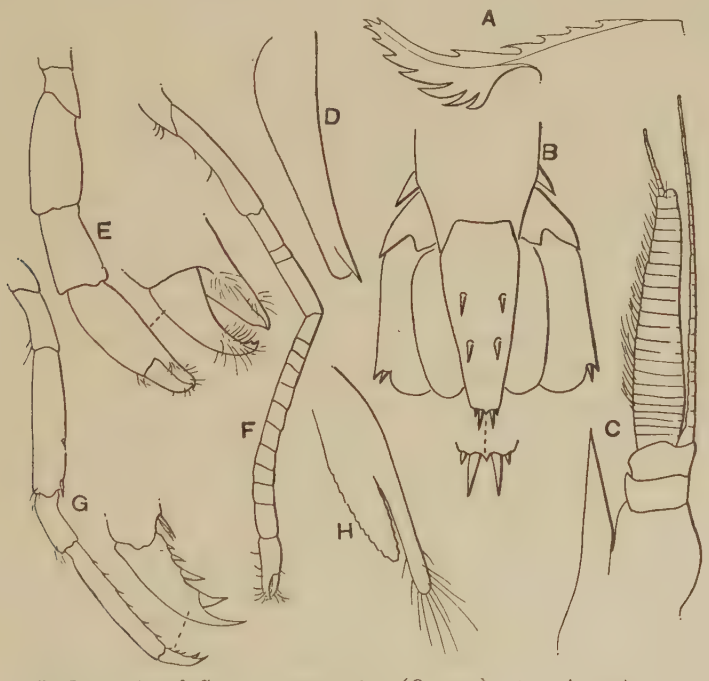


Fig. 5. Body parts of *Saron marmoratus* (Oliver), ♂. *A*. rostrum, ×ca. 10; *B*, tail fan, ×ca. 10; *C*, antennule, ×ca. 10; *D*, antennal scale, ×6; *E*, first thoracic leg, ×ca. 7; *F*, second thoracic leg, ×ca. 7; *G*, third leg, ×6; *H*, endopodite of second pleopod, ×25.

Fig. 6. Mouth-parts of *Saron marmoratus* (OLIVER), ♂. *A*, mandible, ×25; *B*, maxillule, ×25; *C*, maxilla, ×20; *D*, first maxilliped, ×20; *E*, second maxilliped, ×20; *F*, third maxilliped, ×6.

3-segmented, its basal segment carries a prominent lateral spine extending beyond distal margin of this peduncle, penultimate and ultimate segments subequal in length and about one-fourth of basal one, ultimate segment provided with an inner thinner and an outer thicker flagella, the latter proximally uniramous with 24 joints and distally biramous with inner shorter and outer longer branches, the inner branch consisting of 6 segments (Fig. 5, *C*). Antennal scale slender, outer margin terminates in a stout spine reaching well beyond distal margin of lamella (Fig. 5, *D*). Mandible with three-segmented palp, incisor process bearing four teeth along distal margin, molar process stout, provided with a band of thickly set setae in subterminal region (Fig. 6, *A*). Maxillule cross-shaped, apical lobe of endopodite rudimentary (Fig. 6, *B*). Maxilla with unsegmented endopodite, inner proximal endite absent but distal one two-lobed (Fig. 6, *C*). First maxilliped with three-segmented endopodite, basal outer lobe of exopodite rather small (Fig. 6, *D*). Third maxilliped stout, pediform, provided with small exopodite, about 0.4 times as long as body, proportions against ultimate segment: penultimate 0.3, antepenult 0.9, tip armed with four bristles (Fig. 6, *F*). First cheliped rather stout, about 0.3 times as long as body, ratios against movable finger: palm 2.3, carpus 1.8, merus 2.5, movable finger with inturned tip which bears minute subterminal tooth, fixed finger

unarmed (Fig. 5, *E*). Second cheliped slender, a little shorter than half of body, ratios to movable finger: palm 1.5, carpus 8.5, merus 4.5, ischium 5.0, carpus 11-segmented, its 1st and 11th segments equal in length and about twice as long as second to tenth subequal segments, merus three-segmented, middle one the shortest and about one-third of proximal one, distal joint the longest and about one and half times as long as proximal one (Fig. 5, *F*). Third leg slightly shorter than second one, proportions against dactylus: propodus and merus 3.0, carpus and ischium 1.1, merus with two spinules on posterior margin (Fig. 5, *G*), dactylus acutely pointed, somewhat recurved backwards, posterior margin armed with a series of distally larger four teeth.

Fourth leg entirely resembles preceding one in general aspects and proportions. Fifth leg similar to fourth one but merus carries one spinule only near posterior distal margin. Endopodite of first abdominal appendage simple. Endopodite of second pleopod with an appendix interna extending much beyond tip of endopodite (Fig. 5, *H*). Hindmost thoracic sternum armed with a pair of spines. Abdomen provided with two spines on first to third sterna but one middle spine on fourth and fifth sterna.

Branchial formula runs as follows:—

	IV	V	VI	VII	VIII
Pleurobranchiae	1	1	1	1	1
Arthrobranchiae	1	1	1	1	—
Podobranchiae	—	—	—	—	—
Mastigobranchiae	1	1	1	1	—

The above mentioned description and figures are mainly based on a specimen (♂?) measuring 23.0 mm long. Other two specimens (♂?), 13.5 mm and 39.2 mm in body length were also examined, the latter one secured by Mr. S. Saitô from Truck Island (Caroline) in 1937.

Locality: Kusaie: Malem; Truck Isl. (S. Saitô) (Caroline).

Distribution: Australia (Milne-Edwards); Hawaiian Is. (Randall); Oceania and Malay Archipelago (Dana, de Man, Borradaile); Ceylon (Pearson), Mozambique (Bianconi, Hilgendorf); Zanzibar (Ortmann); Arabian coast (Nobili); Red Sea (Heller, Nobili); Karachi; Andamans; Port Canning (Kemp).

Note: The three specimens which came under my examination are entirely the same in all the important characters. All these, judging from general aspects, apper to be male, though the endopodite of the second

abdominal appendage is provided with an appendix interna only as mentioned above.

It seems that the third maxilliped grows faster than the whole body; the percentage ratio of the maxilliped to the body is 40 in the specimen obtained from the Kusaie, 23 mm long, whereas it is 70 in the specimen from the Truck, 39.2 mm long.

Unfortunately, the descriptions of DE MAN (1903) and COUTIÈRE (1910) were not accessible but the specimens under my examination agree well with those of MILNE-EDWARDS (1837), DANA (1852) and KEMP (1914) of this species.

Family GNATHOPHYLLIDAE KINGSLEY (1879)

ORTMANN, 1890, p. 536; RATHBUN, 1902, p. 126; HAY and SHORE, 1918, p. 395; HULT, 1938, p. 6.

Gnathophyllum americanum GUÉRIN

(Text-figs. 7—9)

Gnathophyllum americanum, RATHBUN, 1902, p. 126.
Gnathophyllum fasciolatum, STIMPSON, 1860, p. 28.

Body small. Rostrum short, about one-third of carapace, not reaching to distal margin of antepenult segment of antennular peduncle, obliquely truncate above, upper border armed with five teeth exclusively anterad from posterior margin of orbital notch, but lower border without tooth (Fig. 7, *A*). Antennal spine present, supraorbital and hepatic one absent. Antero-lateral angle of carapace not spiniform. First to fifth abdominal pleura rounded on inferior margin. Telson shorter than uropods, subrectangular but gradually tapering posteriorly to two-fifth its width, distal margin pointed and provided with three pairs of bristles, intermediate one the longest, each dorso-lateral margin armed with two rather long bristles, one at one-seventh and the other at five-sevenths (Fig. 7, *B*). Eyes rather large, well pigmented, cornea with conical, obtuse protuberance. Antennular peduncle three-segmented, basal joint depressed, broad, armed on outer side with proximal leaf-shaped process and distal prominent spine, third joint as long as second one, outer flagellum thicker than inner one, its uniramous basal portion five-segmented, with inner ramus three-jointed (Fig. 7, *C*). Antennal scale triangulary broad, with straight pointed outer margin which does not surpass inner lamella (Fig. 7, *D*).

Mandible without incisor process and palp (Fig. 8, *A*). Maxillule

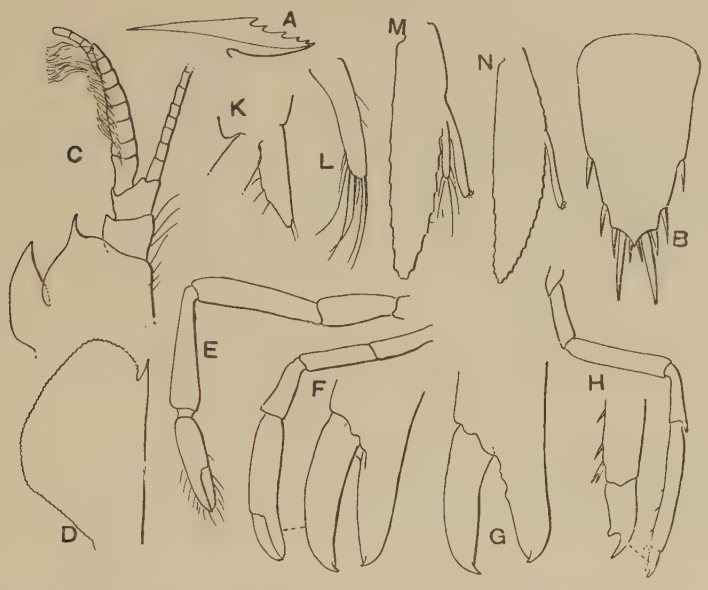


Fig. 7. Body parts of *Gnathophyllum americanum* Guérin, female (*A*~*H*, *L* and *N*) measuring 12 mm in body length, and male (*M* and *K*), 6 mm long. *A*, rostrum, × ca. 10; *B*, telson, × 20; *C*, antennule, ×20; *D*, antennal scale, × 20; *E*, first leg, × ca. 10; *F*, smaller leg of second pair of legs, × 25; *G*, tip of larger leg of second one, × 25; *H*, fifth leg, × 6; *K* and *L*, first pleopod, × 35; *M* and *N*, second pleopod, × 50 in *M* and × 25 in *N*.

cross-shaped, inner endite and endopodite remarkably small and the latter without apical lobe (Fig. 8, *B*). Maxilla with ear-shaped scaphognathite and papilla-like endopodite, inner lacinia absent (Fig. 8, *C*). All three maxillipeds provided with exopodite. First maxilliped with small, unsegmented endopodite, basal lateral lobe of exopodite rather small, inner distal lacinia large, fringed with thickly set hairs along its inner margin, but proximal one almost rudimentary (Fig. 8, *D*). Second maxilliped 5-segmented, basal three joints greatly enlarged, propodus very small, dactylopodite unusually elongated, its inner margin fringed with characteristic hairs (Fig. 8, *E*). Third maxilliped five-segmented, antepenult segment extraordinarily broad, about three times as broad as penultimate segment, ultimate one a little longer than half of antepenult one and somewhat longer and thinner than penultimate one (Fig. 8, *F*). First cheliped slender, about half times the body in length and about 1.5 times as long as third maxilliped, proportions to movable finger: palm 1.1, carpus and merus 3.0,

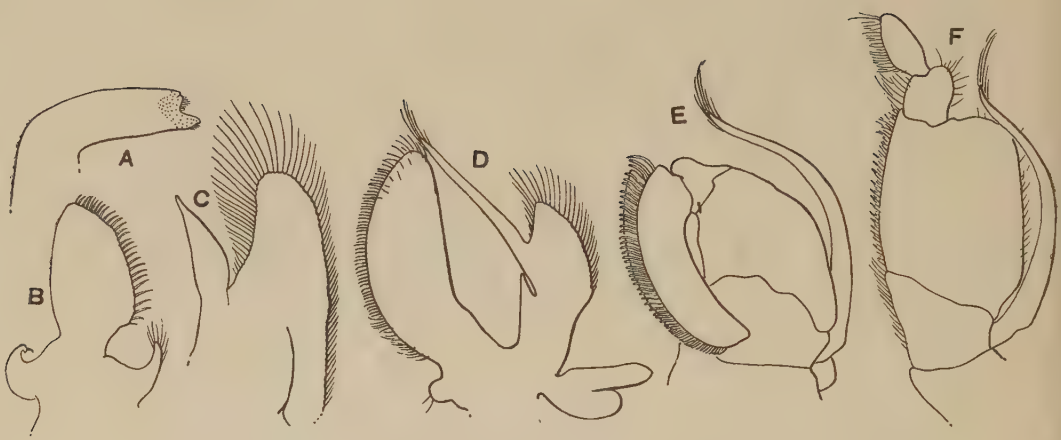


Fig. 8. Mouth-parts of *Gnathophyllum americanum* Guérin, ♀. *A*, mandible, ×36; *B*, maxillule, ×20; *C*, maxilla, ×25; *D*, first maxilliped, ×20; *E*, second maxilliped, ×15; *F*, third maxilliped, ×15.

ischium 1.4, both cutting edges of fingers unarmed and straight (Fig. 7, *E*). Second cheliped asymmetrical, smaller leg a little longer than preceding leg, ratios against movable finger: palm 2.0, carpus and ischium 1.1, merus 1.0, both prehensile edges without tooth; larger chela with three, irregular, small teeth in proximal half of cutting edge of fixed finger (Fig. 7, *F* and *G*). Third leg about 1.5 times as long as first one, proportions to dactylus: propodus 3.8, carpus 1.7, merus 3.0, ischium 1.5, dactylus biunguiculate, propodus armed with several bristles along distal half of posterior margin, carpus, merus and ischium unarmed (Fig. 7, *H*). Endopodite of first abdominal appendage narrow, much shorter than exopodite, distal margin fringed with long hairs (Fig. 7, *L*). Endopodite of second pleopod provided with bar-shaped stylamblys only on inner margin (Fig. 7, *N*).

Colour in alcohol: body crossed by 19 reddish narrow bands (Fig. 9).

The description mentioned above is based on an ovigerous female specimen measuring 12.0 mm in body length. A male specimen, 6.0 mm long was also examined. They were collected on 22th of December, 1937.

Locality: Kusaie, Malem (Caroline Islands).

Distribution: Port Jackson, Australia (Stimpson); Port Stephens, Australia (Haswell); Tahiti (Ortmann); Cuba (Guérin); St. Thomas, West Indies; Gulf of Mexico (Albatross); Bermudas (Goode, coll.); Porto Rico (Rathbun).

Note: Sex recognition is easy by examining first and second abdominal

Fig. 9. Lateral view of *Gonathophyllum americanum*, Guérin, ♀, 12 mm in body length, × 6.

appendages, viz., male differs from female in having such characters: (1) endopodite of first pleopod much smaller, (2) endopodite of second pleopod furnished with a stylamblys and an appendix masculina on its inner margin (Fig. 7, *K* and *M*).

The specimens at my disposal closely resemble Rathbun's description (1902) of the Port Rican specimen in principal characters, but show some descrepancies as given in the following table:—

	Items	Rathbun's specimen	Present specimen
(1)	A small subterminal tooth of lower margin of rostrum	present	absent
(2)	Distal margin of telson	armed with 2 pairs of bristles	armed with 3 pairs of bristles
(3)	Number of colour bands of body	13~16	19

But I am inclined to think that these differences are merely fluctuations within one species.

Family ALPHEIDAE Bate (1888)

Alpheidae, Bate, 1888, p. 528; Rathbun, 1902, p. 104.
Crangonidae (= *Alpheidae*), Hay and Shore, 1918, p. 382; Schimitt, 1921, p. 73.

Synalpheus kusaiensis sp. nov.

(Text-fig. 10)

Rostrum short, slender, sharply pointed, about 0.08 times as long as carapace, not reaching to distal margin of basal segment of antennular peduncle. Frontal spines broad, about three times as broad as base of

rostrum, extending a little short of rostrum (Fig. 10, *A* and *B*). Telson shorter than uropods, inverted subtrapezoid in outline, tapering posteriorly almost by half, each dorso-lateral margin armed with two bristles, one at the middle and the other at three-fourths, distal margin slightly convex, armed with two inner longer and outer shorter pairs of bristles close to postero-lateral angles (Fig. 10, *C*). Antennular peduncle 3-segmented, with distal two segments subequal in length, stylocerite extending to middle of penultimate joint. Antennal peduncle much longer than antennular one, basicerite provided with an external spine which is somewhat shorter than stylocerite. Distal spine of antennal scale projecting far beyond end of lamella. Carpocerite much longer than antennular peduncle and reaches to tip of distal spine of antennal scale (Fig. 10, *A*). Third maxilliped pediform, exopodite present, ratios against pro-dactylopodite: carpopodite 0.25, ischio-meropodite 1.1, ultimate segment fringed with several bristles at apex, penultimate one with bristles on distal upper margin (Fig. 10, *E*). First cheliped asymmetrical, larger leg about 0.85 times as long as body, ratios against movable finger: palm 2.9, ischium 1.1, movable finger carries a large tooth on cutting edge close to base; palm somewhat depressed, a little more than twice as long as wide (Fig. 10, *F*); smaller one about 0.35 times as long as body, proportions against movable finger: palm 1.5, carpus 0.7, merus 2.0, fingers unarmed on prehensile edges and inturned at tips (Fig. 10, *G*). Second leg slender, a little shorter than half of body, movable finger and palm subequal in length, both cutting edges of chela unarmed; carpus six-segmented, about five times as long as movable finger; merus about 0.8 times of carpus, about five times as long as wide; ischium a little shorter than merus (Fig. 10, *H*). Third leg about half of body in length, proportions to dactylus: propodus 3, carpus 2, merus 4.5, ischium 1.8, dactylus biunguiculate, propodus armed with five bristles along its posterior margin, carpus carries a bristle on distal posterior margin (Fig. 10, *K*). Succeeding two pairs of legs closely resemble third pair of legs in general aspects, but fifth one slightly shorter than third one (Fig. 10, *L*). Endopodite of second abdominal appendage lamellar, with minute stylamblys only (Fig. 10, M). Postero-lateral angle of outer uropods provided with three spinules, middle one the longest and largest (Fig. 10, *D*).

Type specimen: female measuring 10 mm long.

Type locality: Kusaie, Malem (Caroline Islands).

Dimensions (in mm) run as follows:—

Body length	10.0	Second leg	4.2

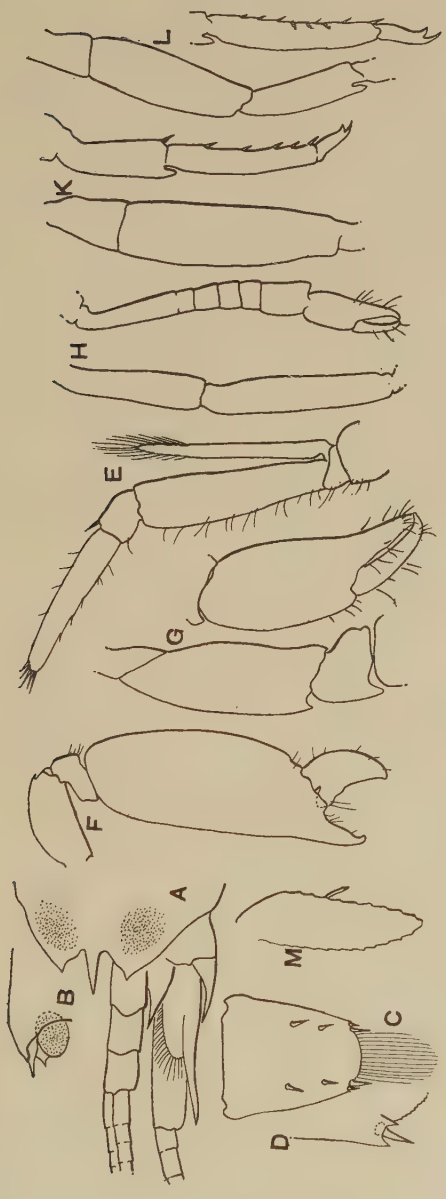


Fig. 10. Body parts of *Synalpheus kusaiensis* sp. nov. *A*, upper aspect of frontal region, ×20; *B*, rostral region in profile, ×15; *C*, telson, ×20; *D*, postero-lateral angle of outer uropod, ×35; *E*, third maxilliped, ×20; *F*, larger leg of first pair of thoracic legs (inner view), ×7; *G*, smaller leg of first pair of thoracic legs, ×20; *H*, second thoracic leg, ×20; *K*, third thoracic leg, ×20; *L*, fifth one, ×20.

Carapace	3.5	Third leg	5.0
First leg (larger)	8.5	Fourth leg	5.3
" (smaller)	3.4	Fifth leg	4.5

The present species is closely allied to *Synalpheus heroni* (COUTIÈRE, 1909, p. 42, Fig. 24) and jointly belonges to *neomeris* group but it is easily separated from the latter in having the following characters:—(1) dactylus of ambulatory legs, without prominence near hte base of the ventral hook, (2) palm of larger cheliped of first pair of legs about three times as long as movable finger (2.4 times in *S. heroni*), (3) distal spine of scaphocerite does not stretch beyond terminal margin of carpocerite.

Synalpheus tumidomanus (PAULSON)

(Text-figs. 11 and 12)

Synalpleus tumidomanus, COUTIÈRE, 1909, p. 24, fig. 5; DE MAN, 1911, pp. 258—260.

Body small. Rostrum slender, somewhat longer than supraorbital spine, about 0.19 times as long as carapace, reaching to about middle of penultimate segment of antennular peduncle. Supraorbital spines well developed, but a little shorter than rostrum, basal breadth about twice as much as that of rostrum (Fig. 11, *A*). Telson subrectangular but gradually reducing its width posteriorly, ratios against width measured at antero-lateral angles: length ca. 1.2, width measured at postero-lateral angles ca. 0.5, each dorso-lateral margin armed with two equidistant bristles; distal margin convex, provided with many long feathered setae and also pairs of outer shorter and inner longer bristles close to the angles (Fig. 11, *B*). Antennular peduncle 3-segmented, middle segment about half times as long as basal one and a little longer than last one which has an acute process outwardly projecting from base and reaching its distal margin (Fig. 11, *C*). Antennal scale slender; its outer spinous part projecting far beyond inner lamellar one and extending to terminal margin of carpocerite (Fig. 11, *C*). Mandible with two-segmented palp, distal margin of incisor process armed with six teeth (Fig. 12, *A*). Maxillule cross-shaped; inner lacinia narrow; outer lacinia rather broad, and fringed with thickly set setae along inner distal margin; endopodite without apical lobe (Fig. 12, *B*). Maxilla provided with ear-shaped scaphognathite, endopodite slender and simple; inner distal endite lamellar, bifid, but proximal one simple and greatly reduced (Fig. 12, *C*). First maxilliped with two-lobed mastigobranchia, basal outer lobe of exopodite narrow (Fig. 12, *D*). Third maxilliped pediform, provided

with exopodite; penultimate joint very short, about quarter of ultimate one, antepenult joint one and half times as long as ultimate one (Fig. 12, *E*). First cheliped asymmetrical; movable finger of larger chela armed with one prominent tooth directed obliquely backwards near base of cutting edge; fixed finger unarmed, with straight cutting edge; palm heavy and swollen, proportions to movable finger: length 2.5, width at middle 1.3 (Fig. 11, *E*); smaller leg about 0.6 times as long as larger one, and a little shorter than half of body, ratios against movable finger: palm 1.5, 0.9 (in width), carpus 0.6, merus 2.0, prehensile edges of both fingers unarmed (Fig. 11, *F*). Second cheliped slender, about 0.6 times as long as body, ratios to movable

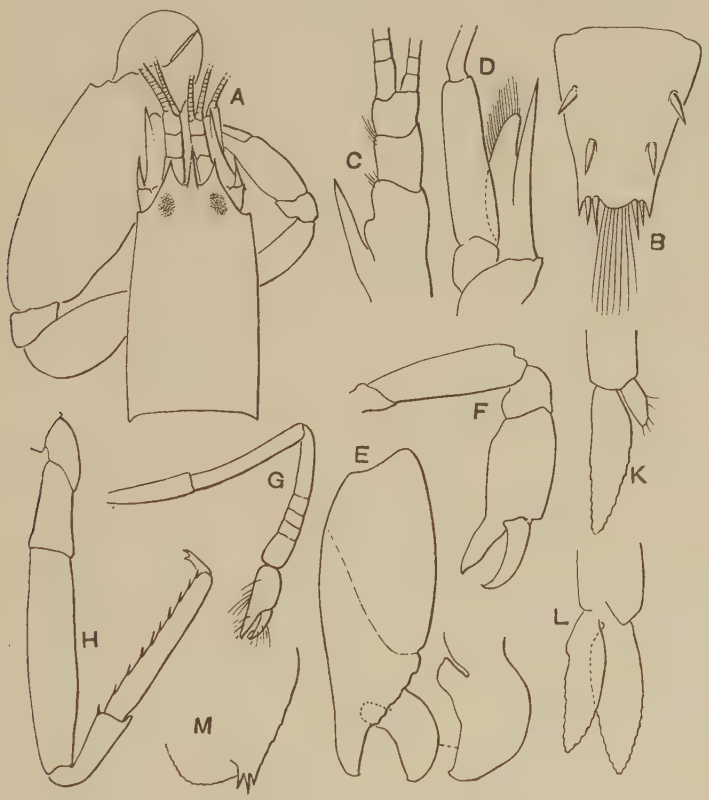


Fig. 11. Body parts of *Synalpheus tumidomanus* (PAULSON). *A*, upper aspect of cephalo-thorax region, × ca. 10; *B*, telson, × 25; *C*, antennular peduncle, × 25; *C*, antennular peduncle, × 25; *D*, basal parts of antenna, × 25; *E*, larger chela of first leg, × ca. 10; *F*, smaller leg of first pair of legs: × 15; *G*, second leg, × 15; *H*, third one, × 25; *K*, first pleopod, × 35; *L*, second pleopod, × 35; *M*, outer uropod, × 25.

finger: palm 1, carpus 4, merus 3, ischium 2; carpus five-jointed, first joint as much as half of its entire length (Fig. 11, *G*). Third leg a little shorter than second leg, ratios to dactylus: propodus 4.6, carpus and ischium 2.2, merus 6.0; dactylus biunguiculate; propodus armed with 9 equidistant bristles along posterior margin, length about 7 times as much as width at middle; carpus provided with a bristle on posterior distal margin; merus unarmed, length about 4.4 times as much as width (Fig. 11, *H*). Fourth and fifth legs closely resemble third one in feature but somewhat shorter than the third one. Endopodites of first and second abdominal appendage lamellar, but the first one decidedly smaller than the latter (Fig. 11, *K* and *L*). Outer uropod armed with three spines at postero-lateral angle (Fig. 11, *M*).

The foregoing description is based on a single male specimen measuring 8.5 mm in body length, obtained from west coast of Babeldaob, Palau Islands at a depth of 30 m on February 21st, 1938.

Distribution: Red Sea (PAULSON); Kabaëna-island, Timor (DE MAN).

Differences of thoracic legs in proportion between the present specimen and DE MAN's description as shown in Table 1 should not be taken significant for taxonomy since they are variable.

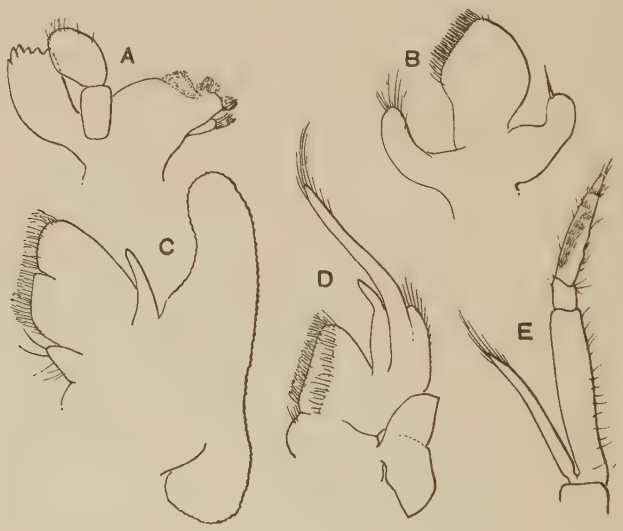


Fig. 12. Mouth-parts of *Synalpheus tumidomanus* (PAULSON) except second maxilliped. *A*, mandible, ×50; *B*, maxillule, ×50; *C*, maxilla, ×50; *D*, first maxilliped, ×35; *E*, third maxilliped, ×20.

Table 1.

Items		Total length		Height		Propodus	
		de Man's specimen	Present specimen	de Man's specimen	Present specimen	de Man's specimen	Present specimen
Ratios to dactylus	1st leg	4.75	5.6	1.7	1.3	—	—
	3rd leg	—	—	—	—	5	4.6

Athanas esakii sp. nov.

(Text-fig. 13)

Rostrum nearly lanceolate, horizontal, toothless, about 0.6 times as long as carapace, extending to or a little beyond the middle of penultimate segment of antennular peduncle (Figs. 13, *A* and *B*). Carapace about 0.3 times as long as body; frontal margin armed with extra and infra-corneal spines; pterygostomian angle rounded. Telson shorter than uropods; subrectangular in upper aspect but gradually reducing its width posteriorly, each dorso-lateral margin armed with two bristles, one at 10/25 and the other at 18 25 of the margin; distal margin convex with two pairs of outer shorter and inner longer (about three times as long as outer one) bristles close to postero-lateral angle, between these bristles the margin is fringed with long hairs (Fig. 13, *P*). Antennular peduncle consists of three segments, basal segment bears a large pointed lateral plate on proximal outer border, ultimate segment as long as penultimate one and provided with two inner and outer rami, outer ramus thicker and shorter than inner one, its proximal portion uniramous comprising three joints, and with shorter and longer branches, shorter one consisting of six segments (Fig. 13, *C*). Antennal scale not tapering, outer margin almost straight, reaching distal margin of antennular peduncle (Fig. 13, *B*). Third maxilliped pediform, penultimate joint the shortest, about half times as long as ultimate one and a little longer than half of antepenult one (Fig. 12, *D*). First chelipeds unusually large and asymmetrical, larger chela about 0.65 times as long as body; proportions against finger: palm 3.5, carpus 0.65, merus 3.0, ischium 0.2; movable finger greatly curved inwards, fixed one provided with a large obtusely pointed tooth near middle of its prehensile edge, both fingers leaving no space between them when closed; palm and merus similarly heavy and more or less swollen, but palm three times as long as wide whereas merus about twice as long as wide; ischium armed with three bristles on distal upper border (Fig. 13, *E* and *E'*). Smaller chela about 0.75 times as long

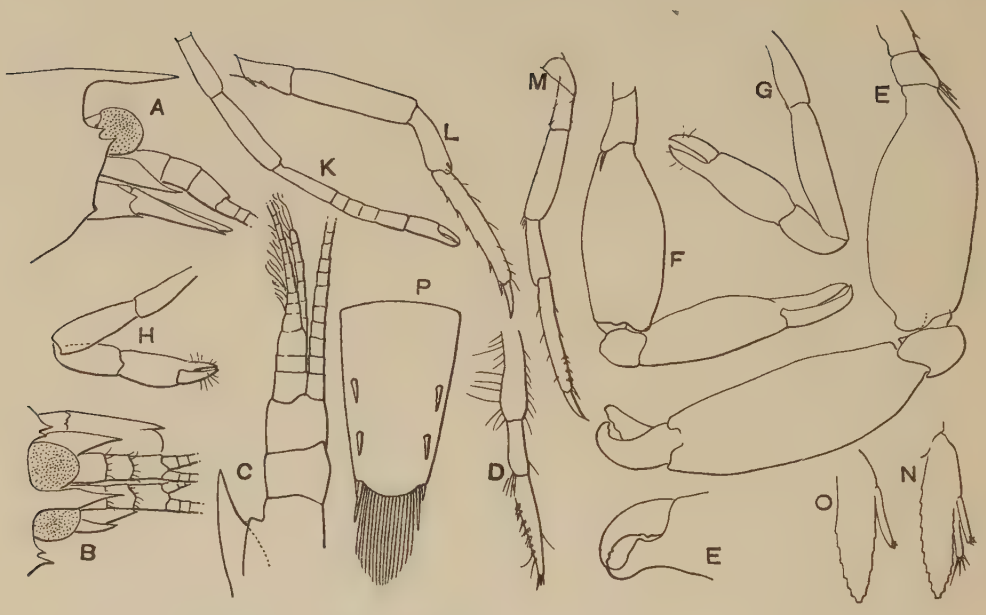


Fig. 13. Body parts of *Athanas esakii* sp. nov., male (*A*~*F* and *K*~*N*) and female (*O*, *H* and *G*). *A*, frontal region (lateral view), ×20; *B*, upper aspect of frontal region, ×20; *C*, antennule, ×25; *D*, third maxilliped, ×25; *E*, larger leg of first pair of pereiopod (outer view), ×20; *F*, same as *E* of the smaller leg; *G*, first leg of female (right), ×25; *H*, same as *G* (left); *K*, second leg, ×20; *L*, third leg, ×20; *M*, fifth one, ×20; *N*, second pleopod, ×50; *O*, same as *N* of female; *P*, telson, ×25.

as larger one; ratios against movable finger: palm 2.0, carpus 0.5, merus 2.3, ischium 0.8; both fingers almost straight with inturned tips and unarmed cutting edges, palm 2.7 times as long as wide, merus entirely resembles that of larger chela in shape and proportion, ischium provided with a bristle on upper distal margin (Fig. 13, *F*). Second cheliped very slender, about half times as long as larger cheliped of first pair, palm 1.1, carpus 5.1, merus 3.8, ischium 2.8 in proportion to movable finger (Fig. 13, *K*). Third leg stouter than second one, about 0.6 times as long as larger cheliped of first pair, proportions against dactylus; propodus 3.4, carpus 1.7, merus 3.2, ischium 1.2; dactylus sharply pointed, unarmed; propodus about one-seventh times as broad as long, posterior margin provided with seven equidistant bristles; carpus carries a bristle near distal outer border; merus unarmed, about four times as long as wide; ischium furnished with two bristles in proximal half of its posterior margin (Fig. 13, *L*). Fourth leg

resembles third one in general aspects. Fifth one shows very close resemblance to third and fourth legs, but somewhat smaller than these (Fig. 13, *M*). Endopodite of second pleopod provided with bar-shaped stylamblys and appendix masculina, which is fringed with setae along distal margin (Fig. 13, *N*).

Female: Female is mostly similar to male, but differs from it in such characters given in the following lines:—First cheliped decidedly smaller than those of male, larger leg about one-third of body in length, proportions against movable finger; palm 1.9, carpus 1.1, merus 2.9, ischium 1.5; both cutting edges of fingers toothless; palm and merus not swollen, the former about twice as long as wide, but the latter with width about one-fourth of its length (Fig. 13, *G*); smaller leg mostly resembles the larger one, proportions to movable finger; palm and carpus 1.4, merus 2.0, ischium 1.8 (Fig. 13, *H*). Endopodite of second pleopod with stylamblys only (Fig. 13, *O*).

Described and drawn from a male specimen measuring 7.0 mm long and an ovigerous female, 6.0 mm in body length. Other two specimens (1♂, 8.4 mm long, first cheliped wanting; 1♀, 6.2 mm long) were also examined.

Type locality: Kusaie, Caroline Islands.

The specimens at my disposal exhibit very close resemblance to *A. djiboutensis* Coutière (1897) and *A. sibogae* de Man (1911), but it is easily separated from the former by lacking supraorbital spine, and from the latter by the following characters: the telson rather shorter, length 2.2 times as much as width between postero-lateral angles (4.2 times in *A. sibogae*), width near proximal margin about 1.6 times of distal margin measured at postero-lateral angles (1.95 times in *A. sibogae*).

Family STENOPIDAE Bate (1888)

Stenopus hispidus Olivier

(Text-figs. 14 and 15)

Stenopus hispidus, Milne-Edwards, 1837, pp. 407~408; Dana, 1852, p. 607, pl. 40, fig. 8; Miers, 1880, p. 458; Bate, 1888, p. 211, pl. 30; Ortmann, p. 539; Borradaile, 1898, p. 1002, Taf. 63, fig. 2; Rathbun, 1902, pp. 99~100; 1906, p. 901; Calman, 1909, p. 706.

Antennal scale rather narrow, outer margin straight and furnished with 5 spinules, outer distal angle armed with a stout spine which extends

far beyond lamella, upper surface of lamella armed with two longitudinal rows of spinules (Fig. 14, *A*). Mandible with three-segmented palp, molar and incisor processes completely fused with each other, distal margin of incisor part with four blunt teeth (Fig. 15, *A*). Maxillule with slender endopodite, inner and outer laciniae equal in size, but the former with truncate distal margin bearing thickly set bristles (Fig. 15, *B*). Maxilla with rather slender endopodite, inner two laciniae equal in size and each of them subdivided longitudinally into two lobes in distal half (Fig. 15, *C*). All three maxillipeds provided with exopodite. First maxilliped with unsegmented endopodite (Fig. 15, *D*). Third maxilliped pediform, 6-segmented (Fig. 15, *F*). Third leg covered with sparsely set setae, both fingers with inturned tips, cutting edge of fixed finger armed with two prominent teeth in proximal half, movable finger with an obtusely pointed tooth which fits between teeth of fixed finger when chela closed (Fig. 14, *B*). Telson lanceolate in outline, distal half of both lateral and distal borders fringed with long hairs, near middle of each lateral border and both antero-lateral and postero-lateral angles provided with a spinule respectively, dorsal surface armed with sparsely set spinules (Fig. 14, *C*).

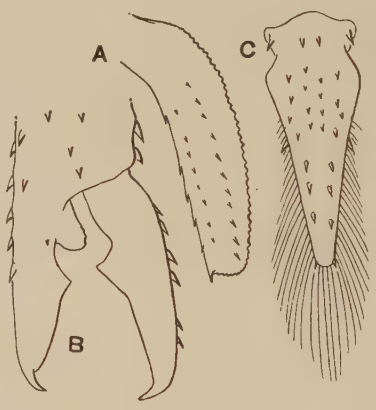


Fig. 14. Body parts of ovigerous female of *Stenopus hispidus* OLIVIER, 18 mm long. *A*, antennal scale, ×15; *B*, fingers of second pereiopod, ×15; *C*, telson, × ca. 10.

Egg spherical, 0.45~0.50 mm in diameter.

The description above mentioned and accompanying figures are based on an ovigerous female specimen, measuring 18.0 mm in body length. One male specimen, 14.0 mm in body length was also examined. They were obtained from Kusai, Malem (Caroline Islands) on December 21st, 1937.

Distribution: Fiji, Bermuda (BATE); Porto Rico, Dry Tortugas, Cuba,

Fig. 15. Mouth-parts of *Stenopus hispidus* Olivier. *A*, mandible, ×25; *B*, maxillule, ×25; *C*, maxilla, ×20; *D*, first maxilliped, ×15; *E*, second maxilliped, ×20; *F*, third maxilliped, ×ca. 7; *G*, endopodite of first maxilliped of ovigerous female, 50 mm long, ×ca. 10.

Jamaica, Bahamas, St. Lucia, Hawaii Isl. (RATHBUN), Christmas Isl. (CALMAN).

Note: The mouth-parts excepting mandible, of this species, have hitherto been described and figured by BATE (1888) on the basis of a female specimen, 45 mm long. The maxilla of the present specimens, measuring 14.0~18.0 mm in body length, does not agree with that of his (figure only, without any description whatever), viz., both inner laciniae of my specimen are bifid in distal half as mentioned above, but those laciniae in BATE's figure are simple and the distal endite is remarkably slender. Moreover in his figure, the endopodite of first maxilliped is drawn as bearing three segments, while it is unsegmented in my specimens. In another male specimen, 50 mm long obtained from Kôtô-syo, Formosa and placed at my dispisal through the courtesy of Mr. Oô-U-Kyô, that is entirely corresponding to BATE's figure (Fig. 15, *G*). Judging from such facts, it appears to me that such descrepancy is probably due to the difference in the size of body.

Literature

BALSS, H., 1914. Ostasiatische Decapoden II. Die Natantia und Reptantia. Abhandlung. math.-phys. Classe K. Bayer. Akad. Wiss. Suppl.—Bd. II, Abhandlg. **10**.

BATE, S., 1888. Report on the scientific results of the voyage of H.M.S. Challenger (Macrura), **24**.

BOONE, L., 1930. Scientific results of the cruises of the yachts "Eagle" and "Ara", 1921~1928, William K. VANDERBILT, commanding (Crustacea). Bull. Vanderbilt Marine Mus., **3**.

BORRADAILE, L. A., 1898. On some crustaceans from the South Pacific (Macrura). Proc. Zool. Soc. London.

CHACE, JR., F. A., 1937. The Templeton Crocker Expedition, VII. Caridean decapod Crustacea from the gulf of California and the West coast of Lower California. Zoologica, **22** (Part 2).

COUTIÈRE, H., 1905. Les Alpheidae in "the fauna and geography of the Maldive and Laccadive Archipelagos" edited by J. Stanley Gardiner, Cambridge, **2**, Part 4.

——, 1907. Sur quelques formes larvaires enigmatiques d'Eucyphotes, provenant des collections de S.A.S. le Prince de Monaco. Bull. de l'Institute Oceanographique, No. 104.

——, 1909. The American species of snapping shrimps of the genus *Synalpheus*. Proc. U. S. Nat. Mus., **36**.

——, 1910. The snapping shrimps (Alpheidae) of the Dry Tortugas, Florida. Proc. U. S. Nat. Mus., **37**.

DANA, J. D., 1852. Crustacea of the U. S. Expl. Exped., **13**, Philadelphia.

FAXON, W., 1895. Reports on the exploration off the west coasts of Mexico, Central and South America, and off the Galapagos Islands. Mem. Mus. Comp. Zool. Harvard Coll., **18**. Cambridge U.S.A.

Gordon, I., 1935. On new or imperfectly known species of Crustacea Macrura. Jour. Linn. Soc. London, **39** (266).

Hay, W. P. & C. A. Shore, 1918. The decapod Crustaceans of Beaufort, N.C., and surrounding region. Bull. U. S. Bureau of Fisheries, **35**, 1915—1916, pp. 371—375, Pls. 25—39.

Hult, J., 1938. Crustacea Decapoda from the Galapagos Islands collected by Mr. Rolf Blomberg. Arkiv för Zoologi, Bd. **30** A, No. 5.

Kemp, S., 1914. Notes on Crustacea Decapoda in the Indian Muscum. V. Hippolytidae. Rec. Ind. Mus., **10**.

Kubo, I., 1935. A description of a new alpheoid shrimp from Japan. Jour. Imp. Fish. Inst., **31** (2).

——, 1938. A new snapping shrimp belonging to the genus *Synalpheus*. Annot. Zool. Japon., **17**, (1).

Lebour, M. V., 1938. Decapod Crustacea associated with the ascidian Herdmania. Proc. Zool. Soc. London.

de Man, J. G., 1911. The Decapoda of the Siboga Expedition (Alpheidae). Siboga-Expediti, **39** a_1.

Miers, E. J., 1880. On a collection of Crustacea from the Malaysian region. Annals Mag. Nat. Hist., Ser. 5, **5**.

Milne,-Edwards, H., 1837. Histoire Naturelle des Crustacés, II.

Ortmann, A., 1890. Die Decapodenkrebse des Strassburger Museum. Zool. Jahrb. (System.) Bd. **5**.

Parisi, B., 1919. I Decapodi giapponesi del Museo di Milano. Atti Soc. Ital. Milano, **58** (1).

Pesta, O., 1918. Die Decapodenfauna der Adria. Wien.

Rathbun, M. J., 1902. The Brachyura and Macrura of Porto Rico. Bull. U. S. Fish. Comm., **20** (for 1900).

——, 1906., The Brachyura and Macrura of the Hawaiian Islands. Bull. U. S. Fish. Comm., **23** (for 1903).

Schimitt, W. T., 1921. The marine decapod Crustacea of California. Univ. California Publications in Zool., **23**.

——, 1933. Four new species of decapod crustaceans from Porto Rico. American Mus. Novitates, No. 662.

Stimpson, W., 1860. Prodromus descriptionis animalium evertebratorum expeditionis ad oceanum pacificum septentrionalem. Proc. Acad. Nat. Sci. Philadelphia.

Yokoya, Y., 1936. Some rare and new species of decapod crustaceans found in the vicinity of the Misaki Marine Biological Station. Japanese Journal of Zoology, **7** (1).

Ecological Studies on the Spiny Lobster, *Panulirus japonicus* (v. Siebold), with Special Reference to its Conservation, I*.

Syuya Nakamura

(Received May 20th, 1940)

As the result of overfishing the Japanese spiny lobster, *Panulirus japonicus*, was nearly depleted in some places, so that the authorities in each prefecture where this crustacean is fished have made various efforts to sustain the yearly yield, viz., setting the close season during the spawning period, restricting the size of the animal to be fished, and so forth. However, for the maintenance of the supply of the animal, it is of paramount importance to have the knowledge of its life history on which any possible means of conservation should be based.

For several years past, the present writer, working at the Kominato Marine Biological Laboratory located on the Pacific coast of Prov. Bôsyû, has been engaged in the ecological studies of this lobster, and elucidated an almost complete life history of the animal in question except larval stages, namely, from Phyllosoma to Puerulus. In the present paper which is divided into 3 sections are given somewhat condensed accounts of a part of my observations as well as proposal of certain measures for the conservation.

The author wishes to express his gratitude to the staff of the Kominato Laboratory and to the members of the Kominato Fishery Guild for their kind assistance rendered throughout the investigation. He is much indebted to Professor A. Terao in the preparation of manuscript.

I. Growth

(A) *Age Determination.* For this purpose, the tagging method as practiced by Kinoshita was not adopted, but indirect age estimation on the basis of investigation into frequency distribution of carapace lengths in the monthly catch was resorted to. From the vicinity of the Kominato Laboratory 4184 individuals were obtained by various kinds of gears from

* Contributoins from the Kominato Marine Biological Laboratory, No. 4.

Table 1.

The spiny lobsters obtained at Kominato, from July, 1936 to April, 1940.

Carapace lengh (mm.)	Jan. ♂	Jan. ♀	Jan. Total	Feb. ♂	Feb. ♀	Feb. Total	Mar. ♂	Mar. ♀	Mar. Total	April ♂	April ♀	April Total	May ♂	May ♀	May Total	June ♂	June ♀	June Total	July ♂	July ♀	July Total	Aug. ♂	Aug. ♀	Aug. Total	Sept. ♂	Sept. ♀	Sept. Total	Oct. ♂	Oct. ♀	Oct. Total	Nov. ♂	Nov. ♀	Nov. Total	Dec. ♂	Dec. ♀	Dec. Total
6.0~	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	2	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
8.0~	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	—	—	3	—	2	2	—	—	—	—	—	—
10.0~	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	4	—	—	5	—	—	5	—	—	—	—	—	1
12.0~	—	—	2	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	5	1	1	8	—	—	2	—	—	—
14.0~	—	—	2	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	1	—	4	—	—	—	—	—	3
16.0~	—	—	7	—	—	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	6	—	—	3
18.0~	—	—	6	—	—	6	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	1	1	6
20.0~	—	—	7	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	1	—	1	2	—	—	6	8	6	16
22.0~	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	—	1	—	1	1	1	1	2	1	—	1	—	—	—	1	—	1	5	5	10
24.0~	—	—	1	—	—	—	—	—	—	—	1	1	1	—	1	1	2	3	5	1	6	3	2	5	—	—	—	1	1	2	—	—	—	3	1	4
26.0~	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	2	—	2	6	3	9	5	3	8	—	2	2	1	—	1	—	—	—	1	2	3
28.0~	—	—	1	—	—	—	—	—	—	—	—	—	1	1	2	2	1	3	5	4	9	13	14	27	5	4	9	3	1	4	—	—	—	—	2	2
30.0~	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	2	2	4	7	8	15	12	9	21	6	3	9	7	6	13	1	—	1	—	6	6
32.0~	1	—	1	—	—	—	—	1	1	—	2	2	—	1	1	2	1	3	11	1	12	17	15	32	13	18	31	5	10	15	2	1	3	9	3	12
34.0~	—	—	—	—	1	1	1	—	1	1	5	6	1	2	3	1	2	3	3	1	4	22	15	37	23	6	29	20	22	42	4	6	10	12	11	23
36.0~	7	4	11	—	2	2	5	4	9	7	1	8	2	2	4	—	3	3	—	6	6	16	12	28	19	15	34	35	15	50	16	13	29	17	27	44
38.0~	4	5	9	2	1	3	8	6	14	10	6	16	3	3	6	7	4	11	1	4	5	16	18	34	33	13	46	27	20	47	13	9	22	28	26	54
40.0~	15	5	20	10	4	14	9	5	14	11	7	18	5	4	9	10	12	22	10	14	24	20	12	32	18	12	30	46	39	85	32	21	53	32	38	70
42.0~	9	4	13	5	2	7	15	3	18	9	8	17	8	8	16	14	18	32	23	26	49	14	15	29	18	7	25	52	29	81	34	16	50	55	56	111
44.0~	12	3	15	7	4	11	9	2	11	25	11	36	10	4	14	23	12	35	20	26	46	16	10	26	14	6	20	33	14	47	31	16	47	57	36	93
46.0~	19	3	22	10	6	16	14	3	17	18	4	22	17	2	19	22	24	46	23	36	59	17	18	35	12	18	30	24	14	38	27	22	49	30	27	57
48.0~	16	2	18	8	4	12	9	6	15	18	7	25	11	5	16	28	11	39	33	38	71	20	23	43	9	14	23	17	13	30	23	7	30	31	13	44
50.0~	14	3	17	2	3	5	12	—	12	15	4	19	13	—	13	24	5	29	42	28	70	27	29	56	1	7	8	8	7	15	15	9	24	18	11	29
52.0~	3	1	4	4	—	4	3	1	4	5	3	8	5	—	5	12	4	16	31	26	57	18	29	47	6	7	13	2	10	12	9	9	18	8	5	13
54.0~	2	3	5	3	2	5	8	—	8	7	2	9	4	—	4	12	5	17	35	15	50	24	10	34	12	9	21	5	10	15	4	5	9	7	7	14
56.0~	—	—	—	2	2	4	2	1	3	5	1	6	4	1	5	9	—	9	20	9	29	18	11	29	11	7	18	3	7	10	1	3	4	3	5	8
58.0~	—	1	1	—	2	2	1	—	1	—	2	2	2	—	2	3	2	5	19	5	24	12	5	17	5	1	6	9	5	14	3	2	5	2	4	6
60.0~	2	—	2	—	—	—	1	—	1	1	1	2	1	—	1	1	—	1	13	6	19	7	5	12	5	—	5	10	2	12	—	1	1	5	8	13
62.0~	1	2	3	—	—	—	2	1	3	—	1	1	—	—	—	2	1	3	3	2	5	7	—	7	2	—	2	7	1	8	3	2	5	2	3	5
64.0~	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3	1	1	2	3	1	4	2	1	3	4	2	6	—	1	1	1	2	3
66.0~	—	1	1	—	—	—	1	—	1	—	—	—	2	—	2	2	—	2	2	1	3	3	1	4	1	1	2	2	—	2	2	1	3	—	1	1
68.0~	—	—	—	—	1	1	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	—	1	—	—	—	1	—	1	1	—	1	—	—	—
70.0~	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	—	1	—	—	—	—	—	—	—	1	1	1	—	1	—	1	1
72.0~	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
74.0~	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	1	—	1

July, 1936 to April, 1940. Table 1 gives the number of the specimens assorted to each month and arranged in classes of carapace lengths in 2 mm unit. No difference appears to exist in the length in question between the two sexes. Therefore, the specimens with the same carapace length were added together irrespective of their sex and plotted in Fig. 1 as histograms. A glance at this figure reveals that there runs a rather regular shift of carapace length through the whole series, starting from July and coming back to it again and again.

Yet, it must be admitted that modes of frequencies are not well defined in some cases and that the smallest size taken as the starting point of the analysis of the data appears not only in July but also in November. But such irregularities are partly due to summing up of the material of various years when the environmental conditions were not the same, and partly to spreading of the spawning season over a long period, say, from May to September. Now, taking the lowering of the water temperature toward autumn into consideration, we may expect much wider range in larval growth than in embryonic development before hatching. This argument is supported by the fact that Puerulus larva of this species is found, as listed in the following table, from early July to late November in the neighborhood of Kominato.

Table 2.

Author	Locality	Date
Nakazawa	Hutomi, eastern Bôsyû	Middle to later parts of September
"	Tateyama, western Bôsyû	August 15th
Present author	"	July 10th to November 25th
"	Kominato, eastern Bôsyû	July 13th

Widely extended as it is, the period of occurrence of Puerulus does not stretch to a date earlier than the spawning season of the same year. Now, to make these mutually dependent facts a coherent story, the egg passes through the embryonic stages, as reported by Terao, in about one month; then Phyllosoma larva changes, in nearly the same interval, to Puerulus one which shortly afterwards becomes an adult, provided the water temperature is not so low.

It would not be far from the truth to say that the smallest adult 6 mm in carapace length grows to one about 30 mm in the corresponding length in one year, since we find a peak in the frequency histogram for July stand-

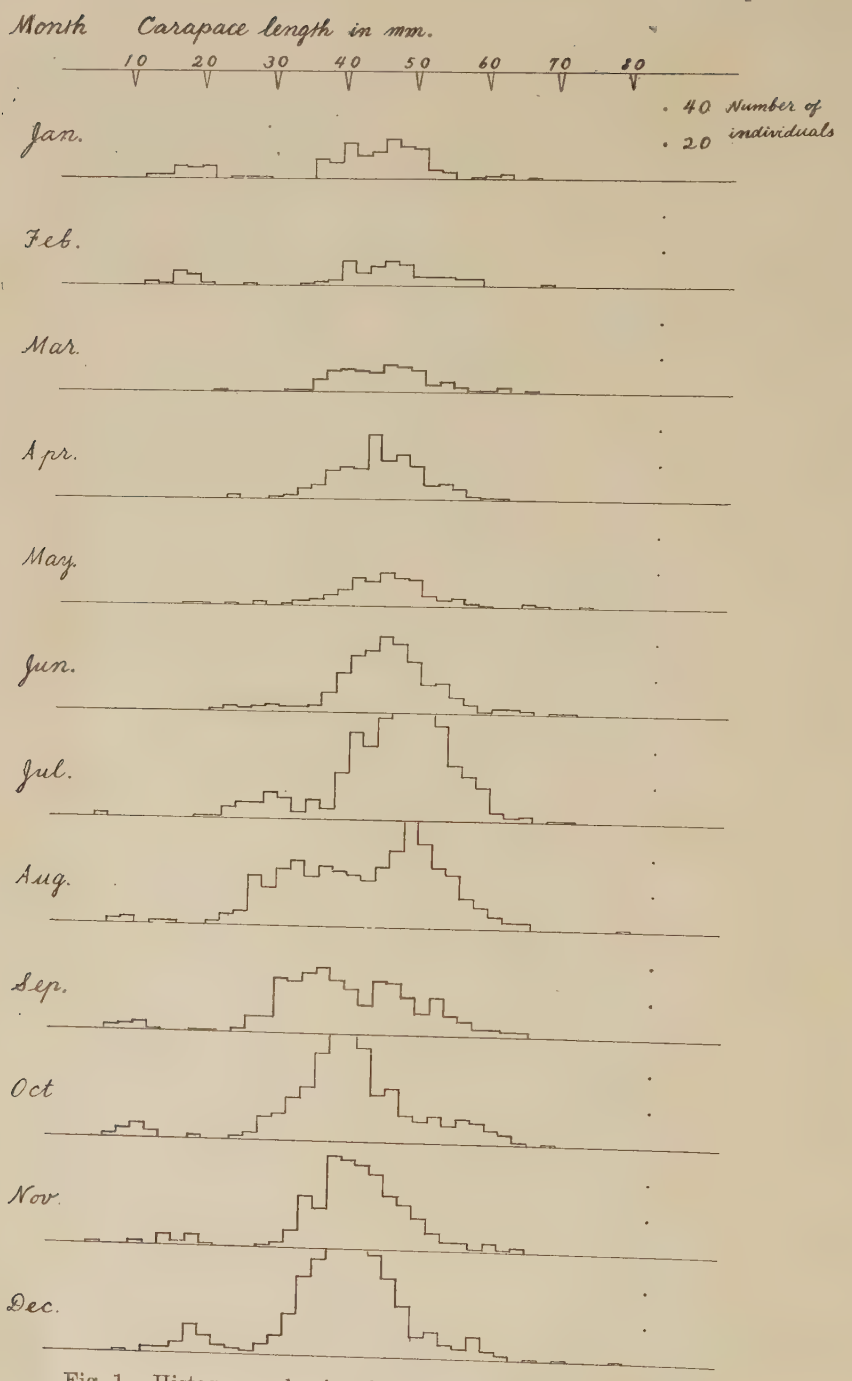


Fig. 1. Histograms showing frequency distribution of carapace length of *Panulirus japonicus*.

ing at such an abscissa (Fig. 1). It would be admissible by the same reasoning to infer that a lapse of time of next one year brings about an individual about 50 mm in carapace length. Although the specimens larger than these are very scanty, I venture to guess that the spiny lobster attains a carapace length of about 65 mm at the beginning of the second year by referring to the carapace length of the specimens obtained in June. It was already briefly alluded to by KIKUCHI (1937) and confirmed by the present author that the males are larger than the females but, since we have no knowledge of this species over 65 mm long, it is uncertain whether the male survives the female or the male grows faster than the female. The age deteamination will be again discussed in connexion with the moulting.

(B) *Moulting.* As inferred by TERAO, the spiny lobster gets rid of its exuviae by making a fissure on its branchiostegite. When the animal approaches moulting period, a fissure is formed along a parabolic line on the branchiostegite beginning from its antero-ventral corner, ascending steeply at first and then running gradually horizontally, and ending on the posterior border of the carapace. First of all, by absorbing the water, the newly shelled body increases its volume, and the greater part of the carapace antero-dorsad from this fissure is then pushed out from within, forming a large gape not only along this fissure but also between the posterior border of the carapace and the abdominal exoskeleton. When observed in a vessel placed in the laboratory, the lobster is found during the act of ecdysis lying on its side. A sort of wriggling is seen from time to time, and first the anterior half of the body begins to come out of the exuviae; then the posterior half is seen also emerging. When almost the whole anterior half as well as one-third of the posterior half are out, the lobster stops wriggling. Instead, the animal gives a strong kick, and the body comes out of the exuviae completely. The time required from the beginning to the end of the moulting amounted to 15 minutes on average. Nearly the whole new exoskeleton is hardened within a day, except the branchiostegite which is still soft for several days.

With a view to finding an increment by exuviation, the animal was tagged previous to the moulting, by TAKAYAMA's method, which consists of burrying one end of a straight silver wire which has a small celluloid tag at the other end into the side of the animal through the fissure on the branchiostegite.

Regarding the rate of growth during the moulting, KINOSHITA (1931) reported 6 to 7% increase by the length in the lobsters 66 to 120 mm long

in total, and HATTORI (1899) reported the increase of 2 mm in a lobster measuring 178 mm. The same author suggested that the moulting in this species takes place throughout the year but more frequently in summer, and also that the younger lobsters shedd their skins at shorter interval than the older ones. VON BONDE (1935) found that *Jasus lalandii* (Milne Edwards) changed, in the aquarium, the skin once or twice within a year.

In the present investigation, such an individual with already the lateral fissure on the carapace and supposed to change its exoskeleton within 1 or 2 days was measured and weighed. These individuals measured and tagged were kept in the aquarium, and after the change of shell, they were measured and weighed in the same way.

Thus, increase in carapace length and body weight in each moulting was measured in 124 individuals, as given in Table 3. Comparing our result with that of KINOSHITA, my finding of increases of carapace length 9.4 to

Table 3.

Increase of carapace length and body weight by a moulting in *Panulirus japonicus*.

Class of carapace length in 2.5 mm units	Number of Specimens	Before moulting		After moulting		Increase obtained by a moulting			
						Actual		Percent	
		Average carapace length	Average weigth	Average carapace lenght	Average weight	Carap. length	weight	Carap. length	weight
20.0～	1	21.0	5.0	23.0	10.0	2.0	5.0	9.5	100.0
22.5～	6	23.7	11.3	27.0	16.5	3.3	5.3	14.1	50.8
25.0～	1	27.0	18.0	31.5	24.5	4.5	6.5	16.7	36.1
27.5～	3	29.2	21.8	33.2	30.7	4.0	8.0	13.7	41.8
30.0～	5	31.0	29.2	34.8	36.7	3.8	7.5	12.3	26.0
32.5～	4	33.1	32.4	37.6	45.6	4.5	13.3	13.6	41.6
35.0～	16	35.9	43.1	39.5	54.2	3.6	10.9	10.0	25.8
37.5～	10	38.3	51.6	42.2	64.1	3.9	10.8	10.1	20.4
40.0～	29	40.9	63.7	44.9	77.3	3.9	13.2	9.5	20.9
42.5～	19	43.3	76.9	47.3	89.8	4.0	12.4	9.3	16.8
45 0～	10	45.5	88.9	50.0	103.6	4.3	14.8	9.4	16.6
47.5～	8	48.2	101.9	51.9	116.9	3.8	15.0	7.9	14.8
50.0～	9	51.4	126.9	56.1	145.1	4.7	19.2	8.9	15.3
52.5～	3	53.8	142.2	59.8	167.7	5.3	25.5	9.9	18.2
55.0～	2	56.3	167.5	59.3	190.0	3.0	22.5	5.3	13.5
57.5～	1	59.0	181.0	62.0	215.0	3.0	34.0	5.1	18.8
65.0～	1	66.9	245.0	71.0	—	5.0	—	7.5	—

16.7% in the lobsters measuring about 22 to 40 mm is larger than his finding, 6 to 7%, in the lobsters of similar size. The increase of 1.1% observed by HATTORI in a lobster measuring 178 mm is also smaller than that we found in the largest specimen. These differences mentioned above are most probably caused by the methods used by the present writer and others. Our specimens were, as already stated, collected from the natural water a day or two proir to moulting so that the lobsters were fully prepared for the acting of ecdysis with accumulated vigor.

More frequent ecdysis is believed to occur during the months of summer and aumumn when animals grow faster than in other months of the year (see Table 1 and Fig. 1). This interpretation harmonizes with the opinions expressed by other workers.

The weight increment was not so regular as that of the length, since the animal does not acquire its full weight so soon after the moulting.

Now, putting the stages equally spaced there is clearly to be seen a logistic trend to the curve of growth of carapace length, just as reported by TERAO (1928) on the American lobster. The estimation from this curve may be of interest. It appears that 10 ecdyses bring a specimen with carapace 6 mm long to a stage with carapace 30 mm in length which is to be taken as of I-age; then 4 times of moulting carry it to a stage 50 mm in carapace length which is presumably of II-age; and III-age is attained by 3 times of moulting from II-age.

TERAO (*op. cit.*) has also shown that the growth in length against actual time may be expressed by a parabolic curve in the American lobster. This is the case with the spiny lobster measured along the carapace.

(C) *Relation between Carapace Length and Body Weight.* This relation was examined in both the male and female of the spiny lobster caught at Kominato. The female appears to be very slightly heavier than the male when we take such specimens ranging from 30 to 60 mm in carapace length. But the former does not differ significantly from the latter in a series of specimens, carapace of which varies from 18 to 112 mm in length, as shown in Table 4 and plotted in Fig. 2 in logarithmic grid.

Therefore, the relation between the carapace length (L) and body weight (W) may be expressed by the formula

$$W = aL^b$$

where a and b represent constants. Computing the approximate values, we have

Table 4.

Average weight of males and females of *Panulirus japonicus*.

Carapace length in mm	Male		Female		Carapace length in mm	Male		Female	
	Number of Specimens	Average weight in gr.	Number of Specimens	Average weight in gr.		Number of Specimens	Average weight in gr.	Number of Specimens	Average weight in gr.
18	2	5.0	1	5.5	49	100	104.8	50	107.6
19	1	6.0	1	6.5	50	100	109.8	50	116.5
20	1	7.0	3	7.2	51	100	116.6	38	122.5
21	7	8.5	6	8.0	52	50	125.3	40	128.0
22	6	9.5	5	9.8	53	50	132.6	25	137.0
23	3	10.5	3	11.5	54	50	137.6	25	145.6
24	10	12.8	6	12.9	55	50	146 7	25	151.5
25	4	13.4	3	14.7	56	40	151.0	20	161.3
26	5	17.3	7	15.6	57	25	160.8	20	166.5
27	10	17.6	4	18.1	58	40	166.6	15	174.4
28	15	19.8	14	20.8	59	19	174 7	12	182.3
29	14	22.4	13	21.9	60	23	185.2	9	196.2
30	15	24.0	10	25.9	61	19	192.3	7	224.3
31	20	26.3	20	27.1	62	16	208.8	4	220.0
32	25	29.8	25	30.8	63	15	218.1	6	234.3
33	25	32.7	23	32.9	64	10	218.0	4	235.0
34	31	34.5	25	36.0	65	1	245.0	3	245.0
35	46	39.2	40	40.0	66	13	251.9	5	255.0
36	50	42.0	50	43.2	67	2	267.5	2	260.0
37	50	45.7	30	46.9	68	3	270.0	1	280.0
38	70	49.4	47	51.4	69	2	285.0	1	290.0
39	50	53.3	50	54.4	70	1	305.0	2	302.5
40	100	58.1	100	59.6	71	6	310.0	—	—
41	100	63.1	50	64.9	73	1	340.0	—	—
42	100	67.8	100	69.2	74	2	355.0	—	—
43	100	72.4	80	73.9	75	1	370.0	—	—
44	100	76.8	50	78.3	80	1	450.0	1	440.0
45	100	82.3	50	83.7	85	1	490.0	—	—
46	100	86.7	50	90.8	105	1	890.0	—	—
47	100	93.4	50	95.6	112	1	1125.0	—	—
48	100	98.7	50	101.8					

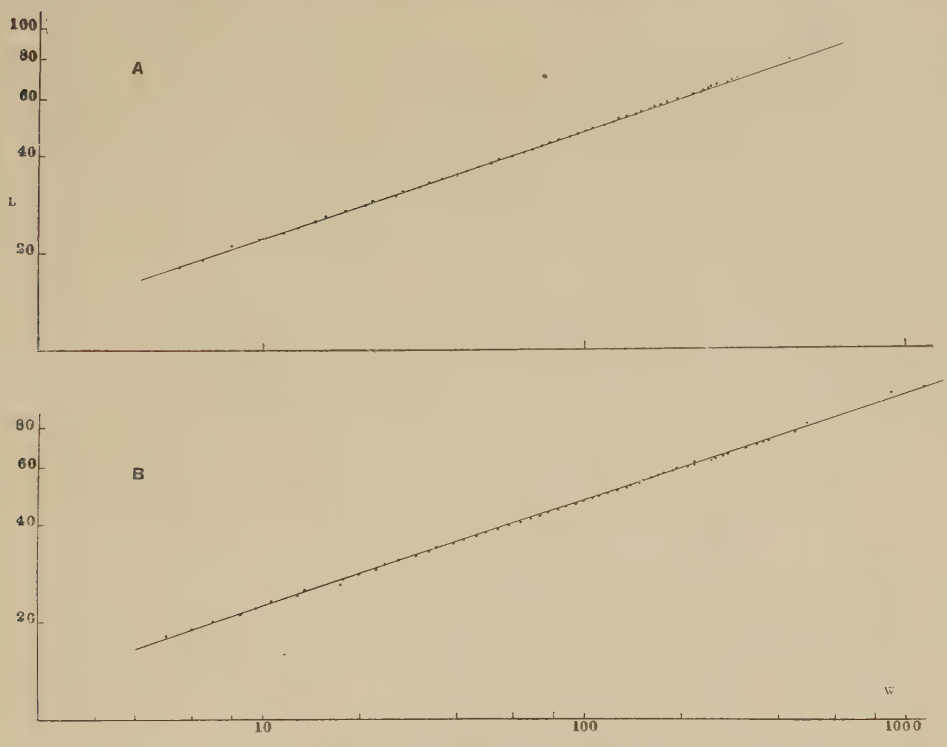


Fig. 2. Carapace length (mm) against body weight (gr.) of female not bearing its eggs (A) and male (B). Logarithmic grid.

$$W = 0.000934L^{2.994} \text{ for female, and}$$
$$W = 0.000982L^{2.974} \text{ for male.}$$

The differences of the values of the constants for each sex are too slight to warrant one to recognize sexual difference in this respect.

II. Biological Minimum Size

As is well known, the females are provided on the abdominal appendages with long setae just previous to egg-laying. The ova are then attached to the hairy out-growths with thread-like cementing substance. The ecdysis subsequent to the hatching of the ova casts off such setiferous exuviae and gives rise to new exoskeleton which is usually destitute of the characteristically long setae on the abdominal appendages. It may be mentioned that I found such long setae on the appendages in question in a number of specimens caught in December, 1939. The hairy out-growths were, however,

white in colour.

It follows, therefore, that the usually coloured long setae indicate that the bearer is a sexually mature female which is to lay eggs soon. Mr. Sigeo KOBAYASI and I examined 170 females, either setiferous or berried, obtained at Kominato from April to October, 1940. As tabulated in Table 5, the smallest of all the setiferous individuals measured 38 mm in carapace length. But such were rather rare, and the majority were found provided with the carapace 50 mm or so in length.

It appears, therefore, that the female spiny lobster enters in sexual maturity mostly toward the end of I-age or at the beginning of II-age but not earlier than the middle of I-age. It is worth noting that KINOSITA's result obtained in Wakayama Prefecture puts the biological minimum size

Table 5.

Berried (B) and setiferous (S) females arranged in months and classes of carapace length (1 mm units).

Class \ Month	April		May		June		July		August		Sept.		October	
	B	S	B	S	B	S	B	S	B	S	B	S	B	S
38~	—	1	—	1	—	1	—	—	—	—	—	—	—	—
39~	—	—	—	—	—	—	—	1	—	—	—	—	—	—
40~	—	1	—	—	—	—	—	—	—	—	—	—	—	—
41~	—	—	—	—	—	—	—	1	1	—	—	—	—	—
42~	—	—	—	—	—	1	1	1	—	—	—	1	—	—
43~	—	1	—	—	—	2	2	5	1	—	—	—	—	—
44~	—	—	—	1	—	2	1	2	—	—	—	—	—	—
45~	—	2	—	1	2	4	1	3	1	—	—	—	—	—
46~	—	—	—	—	1	2	3	4	1	—	—	—	—	—
47~	—	—	—	—	1	—	4	4	2	—	—	1	—	1
48~	—	—	—	1	—	2	4	5	2	1	1	—	—	—
49~	—	—	—	—	—	2	3	3	—	2	—	—	—	2
50~	—	1	—	—	—	2	3	3	1	—	—	—	—	—
51~	—	—	—	—	—	1	2	3	1	—	—	1	—	—
52~	—	—	—	—	—	2	2	3	2	3	—	1	—	2
53~	—	—	—	—	—	—	—	4	2	1	—	1	—	—
54~	—	—	—	—	—	2	1	4	—	—	—	—	—	1
55~	—	—	—	—	—	1	1	—	—	—	—	1	—	1
56~	—	—	—	—	—	—	—	2	—	—	—	—	—	—
57~	—	—	—	—	—	—	—	1	—	1	—	—	—	—
58~	—	—	—	—	—	—	—	1	—	1	—	—	—	1
59~	—	—	—	—	1	—	1	—	—	—	—	—	—	1
60~	—	—	—	—	—	—	1	—	—	—	—	—	—	—
61~	—	—	—	—	—	—	—	—	—	—	—	—	—	—
62~	—	—	—	—	1	—	2	—	—	—	1	—	1	—
63~	—	—	—	—	—	—	—	—	—	—	—	—	—	—
64~	—	—	—	—	1	—	1	—	—	—	—	—	—	—
65~	—	—	—	—	1	—	—	—	—	—	—	1	—	—
70~	—	—	—	—	—	—	—	—	—	—	—	1	—	1
72~	—	—	—	—	1	—	—	—	—	—	—	—	—	—

a little larger than that above mentioned. From an examination of the material from Kôti Prefecture Kubo agrees with him in that respect. These discrepancies are no doubt due to environmental differences in different localities. Judging from all the facts discussed above, we can difinitely state that *P. japonicus* less than 40 mm, or possibly 50 mm long in carapace, should be legally protected from the conservational stand-point, though only the lobsters less than 110 mm in total are legally protected in Tiba Prefecture. In the present time an enormous number of young lobsters measuring less than 50 mm are captured. These small lobsters, however, naturally become mature in the summer of the following year. Thus the prohibition of catching young lobsters less than 50 mm has a great significance for the maintaining of our lobster supply. As regards the size limit in fishing for the preservation of the animal, such local differences should be taken in consideration in respective prefectures.

III. Spawnings Season

The spawning season of *Panulirus japonicus* attains its height either in July or August at Kominato, according to environmental conditions,

Table 6.

Percentages of berried females to ordinary ones caught in June to September, and water temperatures in respective months.
(1) total females; (2) berried females; (3) percentages of (2) to (1); (4) average monthly water-temperature centigrade.

Year \ Month		June	July	August	September
1937	(1)	7	16	40	25
	(2)	1	2	12	1
	(3)	14.3	12.5	30.0	4.0
	(4)	19.3°	22.3°	23.4°	23.5°
1938	(1)	8	47	32	6
	(2)	2	11	2	0
	(3)	25.0	23.4	6.3	0
	(4)	20.2°	23.1°	25.3°	24.7°
1939	(1)	39	92	51	29
	(2)	9	32	18	2
	(3)	23.1	34.8	35.3	7.4
	(4)	19.8°	21.8°	23.5°	24.0°

especially, water temperatures of respective months. In 1937 and 1938, the individuals measuring over 47.5 mm in carapace were examined, because such size—47.5 mm to 52.5 mm—attained by the mature female was studied in the previous section, but in 1939, the individuals less than 47.5 mm were also included when they possessed the hairly out-growths on the pleopods. Table 6 lists percentages of berried females to ordinary ones during June to September 1937 to 1939 inclusive, and average monthly water temperatures. It is clearly seen that the earlier rising of the water temperature caused the majority of the spiny lobsters to spawn before August in 1938 but the later rising shifted the culmination of spawning to August in 1937 and 1939. It may be mentioned that the height of spawning season (KINOSITA, 1934) of the animal in question always lies in July in Wakayama Prefecture where the water is warmer than Kominato in every year. It goes without saying that the conservation regulations put in force in Tiba Prefecture which include June and July in the close season do not meet actual conditions in this prefecture, and that the close season should be extended at least to early August here.

Literature

(1) HATTORI, T. and Y. ŌISI, 1899: On the rearing of *Panulirus japonicus*. I. Jour. Imp. Fish. Inst., vol. 1, no. 2 (in Japanese).

(2) —— and ——, 1901: On the rearing of *Panulirus japonicus*. II. Ibid., vol. 2, no. 1 (in Japanese).

(3) KIKUTI, T., 1937: The so-called "No-ebi" in Kôti Prefecture identical with older specimens of *Panulirus japonicus*. Yôsyokukaisi (Jour. of Society of Pisciculture), vol. 7, no. 9 (in Japanese).

(4) ——, 1939: Natural habitat of male and female of *Panulirus japonicus* in Nagasaki Prefecture. Suisankenkyûsi (Jour. of Fisheries), vol. 34, no. 7 (in Japanese).

(5) KINOSITA, T., 1931: Biological minimum size of *Panulirus japonicus*. Rep. Fish. Exp. Station, Wakayama Pref., no. 28 (in Japanese).

(6) ——, 1932: On the migration and growth of *Panulirus japonicus*. Ibid., no. 30 (in Japanese).

(7) ——, 1931: Some ecological notes on *Panulirus japonicus*. Suisankenkyûsi, vol. 26, no. 7 (in Japanese).

(8) ——, 1934: On *Puerulus* and further metamorphosis of *Panulirus japonicus*. Zool. Mag., Tokyo, vol. 46, no. 551 (in Japanese).

(9) ——, 1934: On the artificial propagation of *Panulirus japonicus* (DE HAAN) and some accounts of its larvae. Proc. 5th Pacific Sci. Congr., Victoria and Vancouver, B.C., Canada.

(10) KUBO, I., 1938: On the sexual dimorphism of *Panulirus japonicus*. Jour. Imp. Fish. Inst., vol. 33, no. 1.

(11) NAKAMURA, S., 1937: Fishing and rearing pond of *Panulirus japonicus*. Suisan-kenkyûsi, vol. 32, no. 9 (in Japanese).

(12) NAKAZAWA, K., 1917: Studies on the metamorphosis of *Panulirus japonicus*, with notes on the ecology of its larvae. Zool. Mag., Tokyo, vol. 29, no. 347 (in Japanese).

(13) ŌSIMA, Y., 1935: On the habitat of *Panulirus japonicus*. Yôsyokukaisi, vol. 5, nos. 5 and 6 (in Japanese).

(14) TAKAYAMA, I., 1939: On a tagging method of *Panulirus japonicus*. Suisan-kenkyûsi, vol. 34, no. 4 (in Japanese).

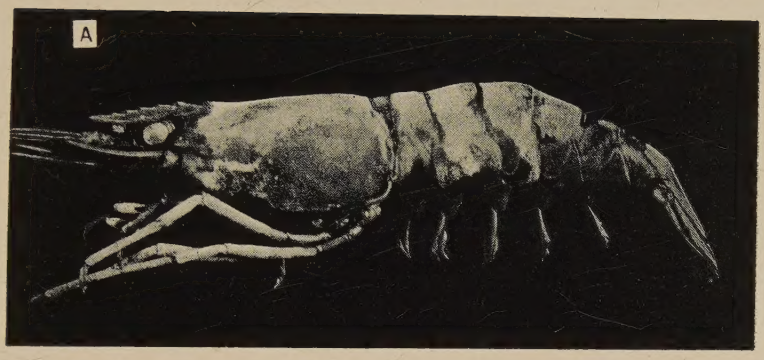
(15) TERAO, A., 1915: Moulting of *Panulirus japonicus*. Zool. Mag., Tokyo, vol. 27, no. 315 (in Japanese).

(16) ——, 1928: Growth of the lobster, *Homarus americanus*. Proc. Soc. Exp. Biol. Med., vol. 25.

(17) ——, 1929: On the development of *Panulirus japonicus*. Japanese Jour. Zool., vol. 2, no. 4.

(18) VON BONDE, CECIL and J. M. MARCHAND, 1935. The natural history and ultization of the Cape Crawfish, Kreef or Spiny lobster, *Jasus* (*Palinurus*) *lalandii* (MILNE). Dep. Comm. Ind. Fish. Mar. Biol. Surv. Div. Fish. Bull. No. 1.

(19) VON BONDE, CECIL, 1935: The reproduction, embryology and metamorphosis of the Cape Crawfish *Jasus lalandii* (MILNE EDWARDS). Dep. Comm. Ind. Fish. Mar. Biol. Surv. Divi. Investigational Report No. 6.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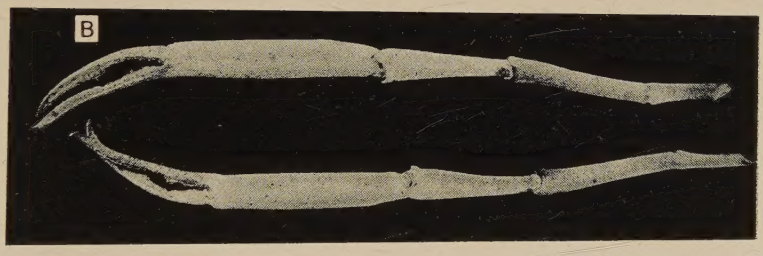
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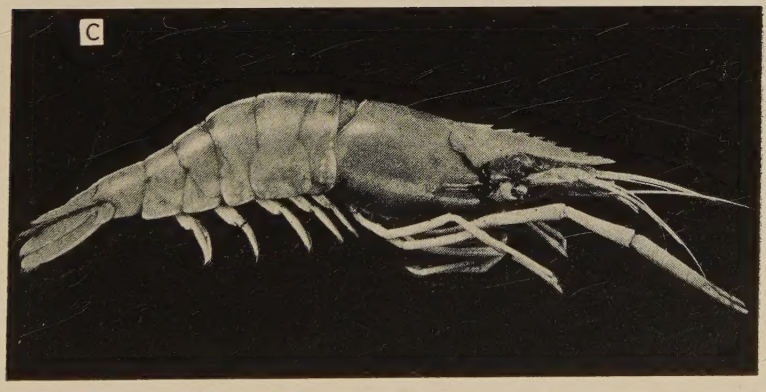
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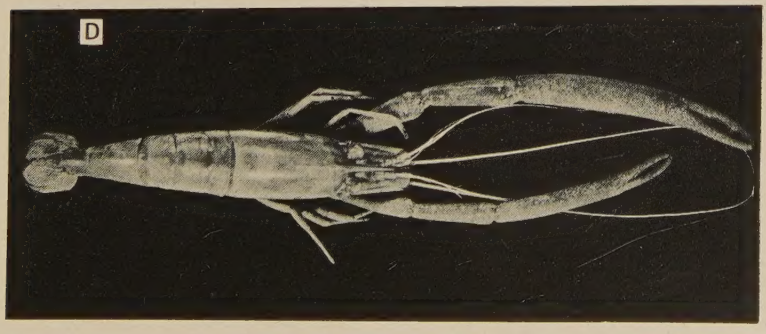
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